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MEDIASTINAL PLEURAL EFFUSION

A ROENTGENOLOGIC STUDY*

By JACOB SAGEL, M.D., *and* LEO G. RIGLER, M.D.

MINNEAPOLIS, MINNESOTA

MEDIASTINAL pleural effusion is of rather infrequent occurrence and is often overlooked due to difficulty in diagnosis. It is usually encapsulated but may rarely, like a free pleural effusion, communicate with the general pleural cavity laterally. It is situated in that part of the pleural cavity which is in relation to the mediastinum. It may be combined with diaphragmatic pleurisy or pericardial effusion.

Anatomically, the mediastinal pleural cavity on each side is divided into two parts, an anterior and a posterior (Fig. 1). The anterior space is bounded by the ribs and sternum anteriorly, the hilus posteriorly, the mediastinal part of the lung laterally, and the heart and mediastinum medially. The posterior space is bounded by the hilus anteriorly, by the ribs posteriorly, by the spine and mediastinum medially, and by the mediastinal part of

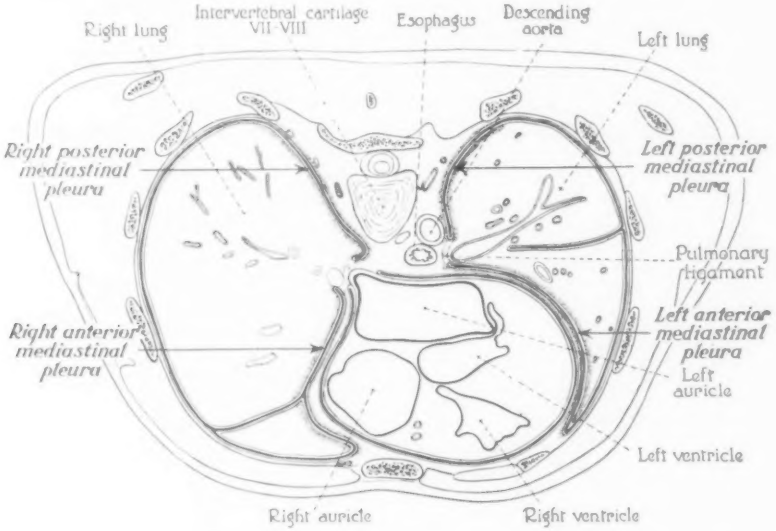

FIG. 1. Cross-section of thorax. The pleural spaces are represented in black. The mediastinal pleural space is stippled and the four divisions are shown. Note the pulmonary ligament which separates the anterior from the posterior mediastinal pleura on both sides.

* From the Departments of Roentgenology of the University of Minnesota, the University Hospital, and the Minneapolis General Hospital, Minneapolis, Minn.

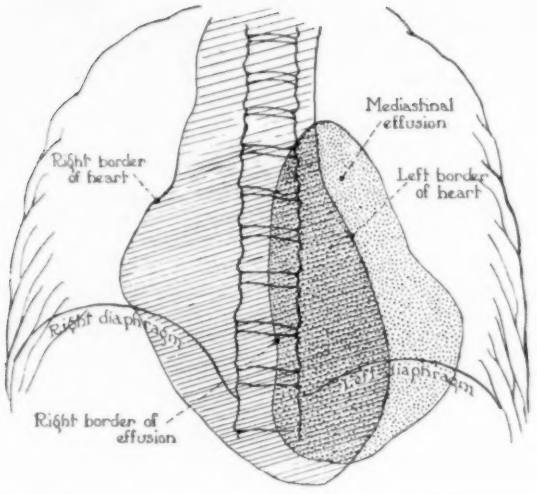

Fig. 2. Diagram of anteroposterior roentgenogram of Case 1. The triangular shadow representing the left posterior mediastinal effusion is shown overlapping the heart shadow which is displaced to the right. Note the increased density of the area in which overlapping is present.

the lung laterally. These two parts of the mediastinal pleural cavity are separated from each other chiefly by the pulmonary ligament, and communicate with each other only above the level of the hilus of the lung. The mediastinal pleural cavity also communicates at the hilus level with the interlobar fissures. Barjon[2] calls this point the "carrefour hilaire," and in some of his cases found the effusion entering these fissures, thus producing in the roentgenogram a round or bean-shaped shadow beside the heart at the level of the hilus.

Considering location, there are four possible kinds of mediastinal pleural effusion: (1) in the anterior space on one side: (2) in the posterior space on one side; (3) the bilateral type, and (4) the so-called "saddle type." In the latter the effusion occurs in both the anterior and posterior spaces by bridging the hilus. Such a case is described by Pel,[9] pus being obtained in both anterior and posterior aspirations, the findings being confirmed at autopsy. Some authors give a slightly different classification. Frick[8] names the following forms: (*a*) pleuritis mediastinalis anterior dextra; (*b*) pleuritis mediastinalis anterior sinistra; (*c*) pleuritis mediastinalis posterior. He makes this distinction because the characteristic symptoms seem to vary according to the part of the mediastinal pleura involved. Chauffard[5] speaks of two types of mediastinal pleurisy, the "pleurésie en bande verticale" and the "pleurésie en equerre." The former appears on the films as a dense linear shadow anterior and parallel to the spine. This is situated far back in the posterior mediastinal pleural cavity and does not spread out over the diaphragm secondarily. In the second type (Fig. 4), which has also been called the costodiaphragmatic type, the effusion is situated more anteriorly and when its upper border reaches the hilus of the lung, it spreads out and assumes the characteristic right-angled shape. Thus, its shape is determined by its anatomical position.

Etiologically, there are two chief types: (1) the serous type, which is generally associated with pulmonary tuberculosis, and

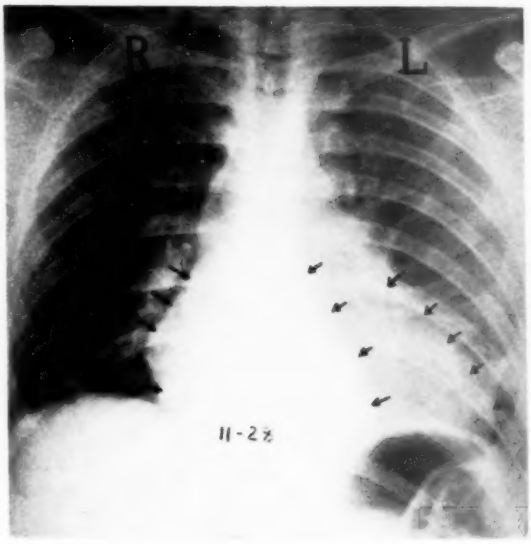

Fig. 3. Roentgenogram of Case 1 showing left posterior mediastinal empyema with displacement of heart to right. Inner row of arrows on left side shows left heart border and outer row of arrows shows lateral border of the empyema. Note increased density where empyema overlaps cardiac shadow. Pus was obtained on posterior thoracentesis on the left side.

(2) the purulent type, which is usually pneumococcic or, rarely, streptococcic in origin. Wessler and Jaches[14] explain the first type by assuming a tuberculous involvement of the mediastinal surface of the lung. The second type is generally secondary to a pneumonia in an adjacent part of the lung. Both of these may terminate as a dry pleurisy which can be readily recognized in the roentgenogram (Fig. 5). Rehberg[11] uses this classification.

There are five points of invasion: from the lung in the presence of pneumonia or tuberculous foci; from the tracheobronchial nodes, which are an important source in children; from the pericardium when an inflammatory process is present, made possible by its very extensive lymphatic network; from the mediastinum and chest wall. The latter includes direct extension from inflammations and tumors of the chest wall, paravertebral abscesses and other miscellaneous rare conditions.

Fig. 4. Roentgenogram of Case 11 taken soon after admission. The right-sided mediastinal empyema assumes a right-angled shape representing the costodiaphragmatic type. Arrows indicate the upper border of the encapsulation. The lower border is spread out over the diaphragm. Note the origin of the fluid from the mediastinal pleura.

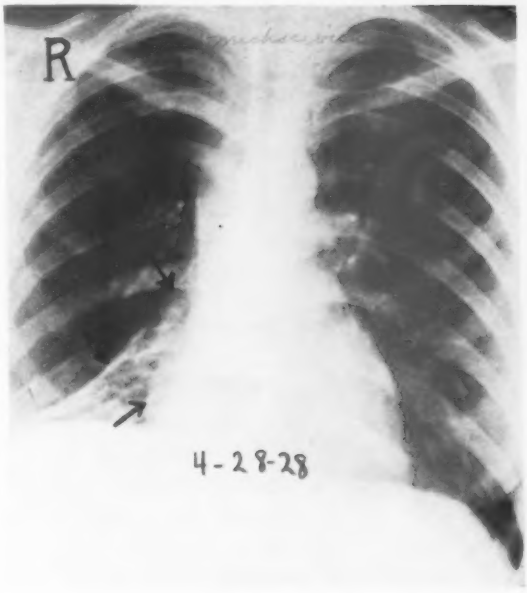

Fig. 5. Roentgenogram of Case 11 taken fourteen months after Figure 4. Outer row of arrows indicates lateral border of thickened pleura representing the residue of the mediastinal empyema. Inner arrow shows right heart border. This is now a dry pleurisy and shows no change from film taken two months previously.

The difficulty of diagnosis by physical examination explains why many cases have not been recognized clinically and were discovered only at autopsy. The physical signs are similar to those in encapsulated effusions elsewhere but are difficult to elicit. They are confusing due to the proximity of the heart and mediastinum to which the encapsulation is closely related. The symptoms are quite similar to those of any infectious disease such as pneumonia with which mediastinal empyema is often associated. In addition, there are symptoms due to pressure on structures in the mediastinum in both the anterior and posterior types of mediastinal pleural effusion. In posterior mediastinal empyema there is a well-known symptom-complex which Dieulafoy[7] has called the "syndrome mediastinale." This consists of dysphagia due to pressure on the

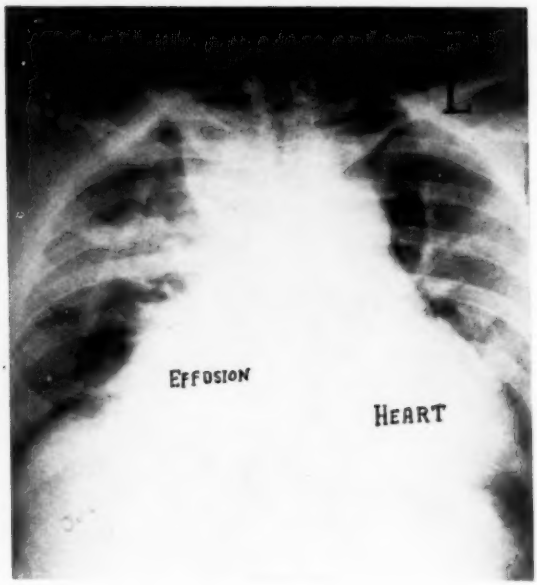

FIG. 6. Roentgenogram of Case III taken with patient supine. Shows a massive right-sided posterior mediastinal empyema. The heart and mediastinum are markedly displaced to the left. Note the appearance of the "double heart" and simulation of a pericardial effusion; 175 c.c. of pus was obtained on posterior thoracentesis.

esophagus, hoarseness due to pressure on the recurrent laryngeal nerve, engorgement of the intercostal veins with the formation of a collateral circulation due to pressure on the azygos vein and paroxysmal cough due to pressure on the vagus nerve. In the right anterior type, cyanosis, limited to the head, neck, thorax and upper extremities, is often a striking feature.

In the anterior type, the differential diagnosis is from exudative pericarditis, anterior suppurative mediastinitis and a free pleural effusion extending into the mediastinal pleura. In the posterior type, the differential diagnosis is from an effusion in the anatomical posterior mediastinal space and from hypertrophied glands, aneurysm, gumma and neoplasms in this region. In discussing the first differential condition, i.e., effusion in the anatomical posterior mediastinal space, Tice[12] points out that this is possible from an anatomical point of view but is very unlikely. Paravertebral abscess may also be confused with this condition, but examination in the prone and lateral positions will show that the shadow is definitely separated from the posterior mediastinal pleural space and has its origin in the posterior chest wall. Also, the shadow of a paravertebral abscess is almost always seen on both sides of the thoracic spine whereas posterior mediastinal pleural effusion is always unilateral. Concomitant changes in the spine associated with paravertebral abscess can usually be demonstrated.

Although this paper is not concerned with treatment, a word on that subject may not be out of order. In the serous type it is not necessary to remove the fluid since it is generally resorbed the same as serous fluid elsewhere in the pleural cavity. Thoracentesis is done only for diagnostic purposes. In empyemata early removal is necessary by aspiration or rib resection with open or closed drainage as indicated. This is essential because of the proximity to

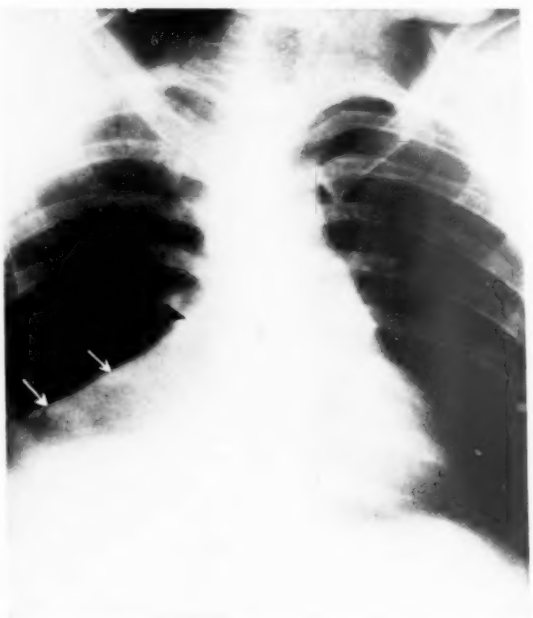

FIG. 7. Roentgenogram of Case IV showing the characteristic triangular shadow on the right of the median shadow extending from the hilus to the diaphragm. Arrows indicate the lateral border of the encapsulation.

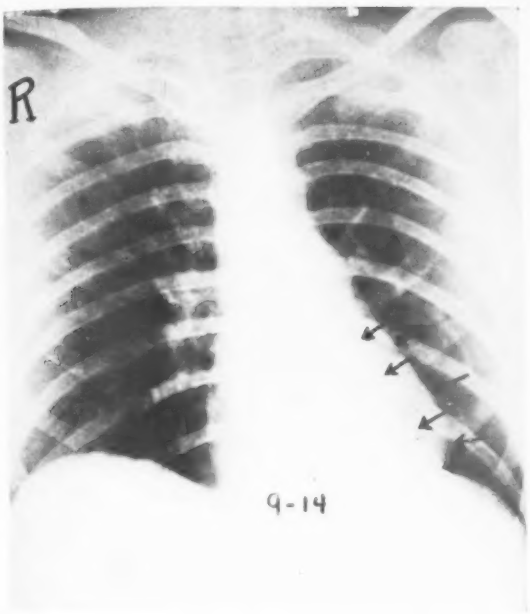

Fig. 8. Roentgenogram of Case v taken in the anteroposterior position. A double shadow is seen to the left of the median shadow. The inner row of arrows marks the lateral border of the mediastinal pleural effusion. The outer row of arrows marks the lateral heart border. Note the characteristic triangular shape of the encapsulation.

important mediastinal viscera. Our experience, which has been chiefly with the posterior type of mediastinal pleural effusion, indicates that the prognosis in this type is generally good, whereas the prognosis in the anterior type is not so favorable.

ROENTGEN DIAGNOSIS

As to the technique of examination, both roentgenoscopic and roentgenographic methods are used. Under the roentgenoscope, the patient is placed in various positions to determine whether the triangular shadow produced by the effusion can be separated from the median (cardiac) shadow. This is very important in the differential diagnosis since a failure to separate this abnormal shadow from the median shadow would point strongly to its origin in the mediastinal pleura. This triangular shadow may be situated on either the right (Fig. 7) or left (Figs. 2 and 3) side of the cardiac shadow and shows no pulsation. A pulsation can be seen on the normal side of the heart but not on the side of the effusion. This point is important in the differential diagnosis from pericardial effusion in which the cardiac pulsation is often transmitted. The shadow of the effusion cannot be separated from the cardiac shadow regardless of the position in which the patient is placed. According to Barjon,[3] it is superadded to the median shadow and deforms and increases it at a point differing according to its location. The adjacent part of the lung or the heart, usually the latter, is often displaced to the opposite side (Figs. 2, 3, and 6). The displacement of thoracic viscera by encapsulated pleural effusions has been noted by Wessler[13] who points out that the displacement depends not only on the size of the effusion but also on its location. A small encapsulation, either basal or mediastinal, may displace the heart because of the direct pressure due to its proximity. On

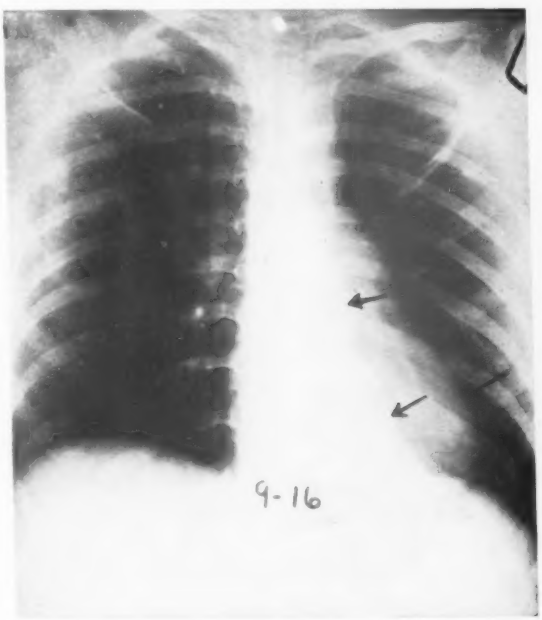

Fig. 9. Roentgenogram of Case v taken two days after Figure 8. Shows a spontaneous decrease in the size of the left-sided mediastinal pleural effusion. Arrows indicate the lateral border of the encapsulation. Compare with Figure 8.

the other hand, a free pleural effusion in the lateral pleural cavity may cause no displacement of the heart and mediastinum until it has obtained a moderate or large

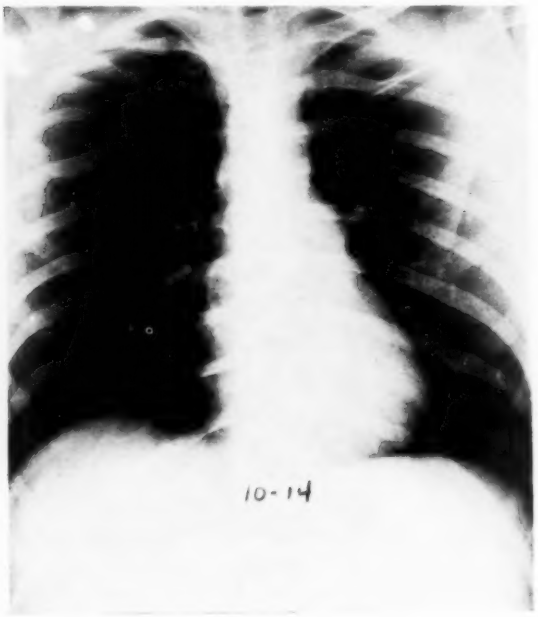

FIG. 10. Roentgenogram of Case v taken one month after onset. Note the absence of the double shadow on the left due to spontaneous absorption of the effusion. Now has the appearance of a normal chest. Compare with Figures 8 and 9.

size. In an anterior mediastinal pleural effusion the heart is displaced only to the opposite side and is not removed from the proximity of the anterior chest wall by the interposition of an exudate as occurs with pericardial effusion. These changes in position are clearly demonstrated on the roentgenogram (Fig. 2).

The roentgenographic findings in mediastinal pleural effusion are fairly typical and have been well described by Devic and Savy[6] in a series of articles. They state that the anterior mediastinal, which in their experience is the most common type, simulates pericarditis with effusion and for this reason has been referred to as "pericarditis externa" and 'pseudo-pericarditis." Posterior mediastinal pleural effusion shows linear shadows anterior and parallel to the vertebral column. This can usually be well demonstrated by films taken in the lateral, oblique and prone positions. The other findings are quite similar to those of the anterior type. Routinely, films are taken in the posteroanterior, anteroposterior, lateral and oblique positions. The most favorable position for roentgenography will be demonstrated by the roentgenoscopic examination. Small posterior effusions on the left side may be readily overlooked in the usual posteroanterior roentgenogram of the chest because of their distance from the film. The anteroposterior film will demonstrate the shadow of the effusion in spite of the superimposition of the cardiac shadow (Fig. 9).

REVIEW OF THE LITERATURE

A review of the literature reveals surprisingly few of these cases reported. Polak,[10] in 1923, was able to find only 26 cases in the literature, all of which were of the anterior type whereas his own case was of the posterior type. This, however, does not represent the true proportion of these types since most of the cases in our series have been of the posterior variety. His report, no doubt, represents less than the actual number since many cases were not diagnosed due to difficulty in recognition by physical examination and lack of development of the technique of roentgen examination. Also, not all of the American cases were included in this review. Frick,[8] in 1910, reported 13 cases of the anterior type and 11 cases of the posterior type including 3 of his own cases. These are the only reports of large series of cases. Barjon[2] reports a case in which the exudate entered the esophagus and was vomited and resulted in spontaneous cure. Devic and Savy[6] report a similar case. Belot[4] reports a case in which the pus entered the trachea or a main bronchus and was coughed up. The effect of pressure on these posterior mediastinal structures, as described by Dieulafoy,[7] has already been referred to. Wessler and Jaches[14] report an interesting case in a

baby three months old. At operation, 6 ounces of pus was removed from the left anterior mediastinal pleural cavity and the shadow on the plate then disappeared.

CASE REPORTS

Our series comprises 15 cases, 6 of which were empyemata, all of the posterior type and proved by thoracentesis. One patient, while in the hospital, developed a right-sided pleural effusion during the course of a pneumonia (Fig. 7). The association with pneumonia suggests very strongly the purulent nature of the effusion but since thoracentesis was not done this could not be determined definitely. The patient made an uneventful recovery. One other patient presented a similar picture, and likewise recovered. Four are cases of dry pleurisy representing the healed stage of a mediastinal pleural effusion. In the other 3 cases aspiration was not done so that it could not be determined whether the effusion was serous or purulent. The clinical picture is usually of value in such cases since high fever, prostration and toxemia would indicate a purulent effusion. Three cases had tuberculosis which was demonstrated both by physical and roentgen examination. Seven cases had pneumonia on admission or just prior to admission into the hospital. One case (a dry pleurisy) had pneumonia in childhood. The remaining cases gave histories of respiratory infections before admission to the hospital, some of which were suggestive of pneumonia. This series demonstrates the close association of mediastinal pleural effusion with tuberculosis and pneumonia. Most of our cases occurred in children. All except one patient recovered but death in that case was due to intercurrent infection (mastoiditis and temporal lobe abscess) after the chest condition was entirely healed.

For purposes of brevity only a few of the characteristic cases are reported in detail.

Case 1. W. R., male, aged twenty-four, entered University Hospital Oct. 29, 1928, complaining of pain in left lower chest posteriorly, chills, fever and cough. The clinical diagnosis was probable left lower lobar pneumonia and possible empyema. Physical examination Nov. 20, 1928, revealed an area of dullness to the right of the sternum extending from the third to the sixth ribs which was interpreted as an encapsulated empyema. A plate of the chest taken at this time showed an encapsulated mediastinal empyema on the left side posteriorly with displacement of the heart to the right. The cardiac displacement to the right accounted for the area of dullness on percussion. Thoracentesis in the tenth left interspace posteriorly was done Nov. 22, 1928, and creamy gray pus obtained. A plate taken Nov. 28, 1928 (Fig. 3), showed a decrease in the size of the empyema with a partial return of the heart to its normal position. Note the increased density where the empyema overlaps the cardiac shadow. Reëxamination Dec. 28, 1928, showed a further decrease of the empyema with a return of the heart to its normal position. The patient made an uneventful recovery and was discharged Jan. 29, 1929.

Three other cases in this series (not illustrated here) presented similar appearances on the films.

Case 11. A.M., female, aged fourteen, entered University Hospital Feb. 18, 1927, complaining of cough, loss of weight, loss of strength, afternoon fever, night sweats, and pain in the right lower axillary portion of the chest. She was raising large amounts of yellow-green pus. Her temperature was of the septic type during most of her stay in the hospital. A roentgenogram of the chest shortly after admission showed a shadow along the right heart border and extending out over the diaphragm (Fig. 4). Note the origin of the fluid from the mediastinal pleura. Thoracentesis was done and purulent fluid obtained which showed many pus cells but no tubercle bacilli. Plates were taken at intervals over a period of fourteen months and some of these are reproduced here to show the steps in the healing of the mediastinal empyema. The last plates taken April 28, 1928, show a mediastinal pleurisy as the end stage of the infectious process illustrating the characteristic picture of the healed dry pleurisy (Fig. 5).

Four other cases in this series show a similar picture. This case is an example of what

Chauffard[5] has named the "pleurésie en equerre" (the right-angled type) of mediastinal pleural effusion. It is one of the rare cases in which an effusion originating in the mediastinal pleura communicated with the lateral pleural cavity in the manner of a free pleural effusion instead of becoming walled off as usually occurs.

CASE III. C.P., female, aged thirty-eight, entered the Minneapolis General Hospital May 22, 1925, complaining of spells of unconsciousness and convulsions. While in the hospital she developed a right lower lobar pneumonia which was followed shortly by an encapsulated mediastinal empyema. Roentgen examination of the chest at this time (Fig. 6) revealed a triangular shadow extending out from the right hilus toward the periphery. The heart and mediastinum are displaced to the left. The appearance simulates a double heart shadow and pericardial effusion. Roentgenoscopic examination demonstrated the posterior position of this effusion. Thoracentesis below the angle of the right scapula in the paravertebral region was done and 175 c.c. of thick green pus was obtained. This was followed by closed drainage and healing of the empyema. The patient then made an uneventful recovery.

One other case in this series (not illustrated here) presented a similar picture.

CASE IV. H.P., male, aged twenty-seven, entered the Minneapolis General Hospital April 6, 1925, complaining of pain in the right anterior chest of three days' duration, cough, hemoptysis, chills, fever and general malaise, all of two days' duration. Sputum examination revealed pneumococci. A film of the chest made on admission showed a right middle lobar pneumonia. A film of the chest made three days later showed extension of the pneumonia to the right lower lobe. Roentgen examination of the chest April 18, 1925, showed almost complete resolution of the pneumonic consolidation in the right middle and lower lobes. At this time a triangular shadow was seen extending out from the right hilus and right heart border over the diaphragm toward the periphery (Fig. 7). This is characteristic of an encapsulated mediastinal pleural effusion probably purulent in nature. The patient made an uneventful recovery without aspiration.

CASE V. C.S., female, aged fifteen, entered University Hospital Sept. 9, 1929, complaining of purulent discharge from right ear, chills and fever. Mastoidectomy Sept. 13, 1929. Roentgen examination on admission showed bilateral bronchopneumonia and mastoiditis with cell destruction. Examination Sept. 14, 1929, showed left mediastinal empyema and healing bronchopneumonia (Fig. 8). Examination Oct. 4, 1929, showed partial healing of mediastinal empyema (Fig. 9). Examination Oct. 14, 1929, showed complete healing of the mediastinal empyema (Fig. 10). Patient later developed a temporal lobe abscess which caused death.

This case demonstrates well the triangular shadow produced by the effusion and its close relation to the cardiac shadow. Plates taken with patient supine brought out the posterior position of the effusion which was not demonstrated in the routine posteroanterior films.

SUMMARY

1. Mediastinal pleural effusion is not so infrequent as formerly believed and is often overlooked clinically due to difficulty in diagnosis.

2. It is generally encapsulated but may rarely occur as a free pleural effusion and extend secondarily into the lateral pleural cavity.

3. The purulent type generally follows pneumonia and should be sought for when return to normal does not occur after the usual period of illness.

4. The characteristic roentgen finding is a triangular shadow on either side of and continuous with the median shadow and from which it cannot be separated regardless of the position in which the patient is placed. It may displace the adjacent part of the lung or heart, usually the latter, to the opposite side. No cardiac pulsation is visible in this abnormal shadow.

5. In some cases typical symptoms are produced due to pressure on structures in the mediastinum.

6. Early removal is indicated in the empyema due to proximity to important mediastinal viscera.

7. In our series of 15 cases the posterior type has predominated and recovery occurred in all but one case. Six were empyemata in the posterior space and were proved by thoracentesis. All of them recovered.

REFERENCES

1. Assmann, H. Die Röntgendiagnostik der Inneren Erkrankungen. F. C. W. Vogel, Leipzig, 1921, p. 251.
2. Barjon, F. Les pleurésies enkystées de la région du hile. *J. de radiol. et d'électrol.*, 1914, *1*, 177–182.
3. Barjon, F. Radio-Diagnosis of Pleuro-Pulmonary Affections. Yale University Press, New Haven, 1918, p. 46.
4. Belot, J. Un cas de pleurésie médiastine. *Bull. et mém. Soc. de radiol. méd. de Par.*, 1914, *6*, 194–196.
5. Chauffard, A. Des pleurésies séreuses médiastines. *Presse méd.*, 1902, *10*, 363–365.
6. Devic, E., and Savy, P. Les pleurésies médiastinales. *Rev. de méd.*, 1910, *30*, 365; 460; 499.
7. Dieulafoy. Pelurésie médiastine à pneumocoque. *Presse méd.*, 1896, 281.
8. Frick, A. The different forms of mediastinal pleurisy, with report of three cases. *J. Am. M. Ass.*, 1910, *55*, 2042–2048.
9. Pel, P. K. Ein merkwürdiger Fall von Empyem. *Berl. klin. Wchnschr.*, 1884, *21*, 113–116.
10. Polak, J. B. Pleuritis mediastinalis. *Acta radiol.*, 1923, *2*, 461–467.
11. Rehberg. Ueber mediastinale Pleuritis. *Med. Klin.*, 1920, *16*, 1033.
12. Tice, F. Posterior mediastinal pleurisy. *M. Clin. N. Am.*, 1921, *5*, 157.
13. Wessler, H. Diagnosis of encapsulated pleural effusions. *M. Clin. N. Am.*, 1920, *4*, 69.
14. Wessler, H., and Jaches, L. Clinical Roentgenology of Diseases of the Chest. Southworth Publishing Co., Troy, N. Y., 1923, p. 347.

BONE LESIONS IN TARDIVE HEREDOSYPHILIS*

By EUGENE P. PENDERGRASS, M.D., ROBERT L. GILMAN, M.D., *and* KENNETH B. CASTLETON, M.D.

PHILADELPHIA, PENNSYLVANIA

TERMINOLOGY in speaking of hereditary syphilis has frequently been loose and misleading. Stokes[72] has pointed out the misuse of the terms in this connection and the tendency to use as synonyms the words "congenital" and "hereditary." He says in part:

"Heredosyphilis," essentially a misnomer, but a very convenient term may be used to include the type of infection of the child which takes place via the placenta and the maternal and fetal blood-streams. "Congenital" syphilis, though widely used in place of "heredosyphilis," may be applied more strictly to that type of the disease which follows infection of the fetus in passing through the birth canal . . . . and thus a variety of acquired syphilis. . . . . The child infected early in uterine life with a relatively mild type of the disease may remain asymptomatic except for developmental stigmata for months or years before showing active signs of the disease. This constitutes the tardive form of heredosyphilis.

Our main interest lies in the bone lesions of the late heredosyphilis, but we have included reference to the bone lesions of prenatal syphilis in general, making a distinction where possible between congenital and heredosyphilis except when a previous observer or reporter of cases has failed to qualify his use of one or the other terms. Whereas late heredosyphilis does not refer specifically to the age of the patient except as a relative term, we have been more interested in the type which is not recognized in the child until early adolescence, although other lesions may have appeared at an earlier age.

A résumé of the pathology involved is that specifically of congenital syphilis which together with the pathology of acquired bone syphilis illustrates in effect the fundamental processes involved in heredosyphilis. It is to be noted that all of Wegner's work quoted in the body of this paper refers to congenital syphilis. In a previous paper, one of us[56] has reported in detail the roentgen findings in congenital syphilis.

HISTORICAL

Rosen,[62] in 1747, was the first to direct attention to involvement of bones in prenatal syphilis. In 1793, Rosenstein[63] offered the first criteria of diagnosis in children with osseous syphilis. He advised a thorough examination of the inferior maxilla, the cranium and the extremities for tumors and exostoses. Bertin,[9] in 1810, emphasized the importance of certain exostoses and periosteal swellings in relation to congenital syphilis, and likewise observed the ivory-like hardness with which these bones cut on autopsy. He noted the periosteal response to mercury and described the case of a male infant with a pigeon-egg-sized tumor on the left greater trochanter which resolved promptly following specific treatment. Valleix[80] demonstrated the occurrence of epiphyseal separation at autopsy in 1834. Lancereaux[37] reported in 1851 on his observations in 6 cases of disease involving the nasal and cranial bones. Diday[20] in his treatise on syphilis in new-born children gave but little space to this subject and wrote that bone lesions were infrequently observed. In a later translated edition his editors added subsequent observations in their footnotes. In 1861 Bouchut[11] attributed a luetic origin to a peculiar premature induration of the shafts of the long bones, making them solid and compact and difficult to cut at autopsy. He reported also on the softening process of the epiphyseal cartilage terminating in suppuration under the periosteum. Ranvier[60] noted in

* From the Department of Roentgenology and the Department of Dermatology and Syphilology, Hospital of the University of Pennsylvania, Philadelphia.

1865 the retarded ossification and epiphyseal separation occurring in the long bones. Barton[7] believed that periostitis and disease of the bones was rarely seen in infants with congenital syphilis, with the exception of the involvement of the nasal bones. This view was likewise held by Berkeley Hill.[8] It was not until Wegner[87] in 1870 and Parrot[53,54] in 1871 and 1873 that the early varieties and pathology of congenital bone syphilis were clearly defined and that a substantial differentiation was made between syphilis and rickets.

Wegner evolved a working classification based upon the first comprehensive histological study of the bones in congenital syphilis. Parrot, using a longitudinal section of long bone from a new-born syphilitic infant, demonstrated a modified layer of ossification between the epiphysis and the diaphysis. He also described the osteophytic cranial bones and the pseudoparalysis which bears his name. Parrot agreed in part with Wegner's conception of the histological process but insisted that new osteophytic formations were of the greatest significance. Cornil's[16] test in 1878 was one of the first to include a comprehensive amount of material on the bone lesions of hereditary syphilis and included a lengthy critical discussion on the newer pathological studies announced in that decade by Wegner and Parrot. Subsequent case reports and discussion in the late nineteenth century included those of Feulard,[23] Sutherland,[75] Morgan,[50] Apert,[5] Cuff,[18] and Fraenkel.[26]

INCIDENCE AND INVOLVEMENT

Fournier[25] found bone disease in 82 of 212 cases of hereditary syphilis (40 per cent) with an age incidence ranging from three to twenty-eight years and with a mean of twelve. Hochsinger's[31] percentage was the same with a smaller series of cases. Villemin[81] found bone changes in 90 of 200 cases (45 per cent) while Dennie's[19] series of 50 cases of bone syphilis represented 6 per cent of his total heredosyphilitic patients.

Most observers have noted that the ends of the long bones are most generally involved, particularly the tibia and the bones of the elbow. Wegner found the inferior extremities of the femur and humerus to be most commonly involved in his cases, but his patients represented only the lesions of infancy. Abt,[1] Villemin, Gaucher,[28] Weber,[86] Ménard, Le Moine, and Pénard,[46] and Broca,[13] agree on the frequency with which the long bones are attacked, particularly the tibiae.

Stokes in 202 cases of hereditary bone syphilis found cranial bosses in 43 per cent, sabre tibiae in 43 per cent, saddle nose in 30 per cent, and enlarged epiphyses in 13 per cent. He also noted a general osseous over-development, particularly in the heaviness of the limbs and columnar massiveness of the bony frame with a lack of modeling of the lower extremities. In Stokes' experience, Charcot joints and spondylitis are of rare occurrence. Tubby[78] and Villemin also agree on the rarity of spinal involvement. Levy-Bing and Duroeux,[41] and Addison,[3] reported on cases of Charcot knee in sixteen year old patients. Gaucher believed that suppurative osteoperiostitis was of unusual occurrence. Villemin commented on the rarity of clavicular involvement, while Tubby found the incidence of rib and clavicular involvement to be about equal. Wegner in his original communication noted that prenatal bone involvement occurred in several long bones at a time. Dennie's recent experience led him to believe that multiple bone involvement occurs only in heredosyphilis—that it may be simultaneous but usually one bone after another is affected.

The majority of active bone disease in heredosyphilis occurs between the ages of five and twelve with the possibility of sabre shin appearing up to the fifteenth year (Tubby). Stokes, quoting Fournier, extends the period of late bone manifestations from three to twenty-eight years with

TABLE I

REPRESENTATIVE CASES OF TARDIVE HEREDOSYPHILIS; BONE LESIONS IN PATIENTS OF TWELVE OR OVER

Author	Date	Patient	Lesions	Onset	Additional Findings
Post[59]	1898	Man of 22	Swollen knees		Scars at angle of mouth, teeth, deafness, and corneal scarring.
Hutchinson[32]	1900	Man of 28	Thickened tibiae with chronic periostitis of the femur		Stigma, eyes and nose.
Abt[1]	1903	Boy of 15	Involvement of knees, elbows and tibiae. Swollen ankles	At age 10	Hutchinsonian incisors.
Lévy-Franckel[42]	1906	Man of 55	Suppurative osteomyelitis with red, swollen, ulcerated, feet.	At age 53	Had interstitial keratitis at the age of 4 years.
Gaucher[28]	1906	Man of 37	Suppurative osteomyelitis of the skull. Luetic spina ventosa.	At age 30	Additional stigmata of heredosyphilis.
Gaucher[28]	1906	Man of 33	Tibial osteoperiostitis with abscess	Traumatic, at age 6	Stigma, nose and teeth.
Tscherniawski[77]	1906	Boy of 15	Osteochondritis of the tibiae. Luetic spina ventosa		
Stadler[70]	1907	Boy of 17	Pain in forearms and ankles with sabre tibiae	At age 8	Roentgen confirmation.
Villemin[81]	1908	Boy of 14	Osteochondritis of the tibiae	At age 6	Night pains.
Parkinson[55]	1908	Girl of 21	Large tibiae, ulnae, and lower femora. Tender joints with fluid		Interstitial keratitis at the age of 8 years. Infantile. Submentally.
Gaucher and Giroux[29]	1908	Woman of 24	Ulceration of the leg	At the age of 15, 18, 22	
Dittrich[21]	1909	Girl of 12	Swelling at the center of the left tibia with ulceration	Traumatic 6 mos. ago	Other signs of heredosyphilis.
Saunders[65]	1910	Girl of 12	Enlarged knees and periostitis of tibiae	At age 11	
Mann[45]	1912	Girl of 12	Involvement of knees, hips and shoulders		Subsequently developed an interstitial keratitis.
Trimble[76]	1912	Girl of 21	Symmetrically enlarged and thickened tibiae, with a rarefying osteoperiostitis	At age 5	

TABLE I (*Continued*)

REPRESENTATIVE CASES OF TARDIVE HEREDOSYPHILIS; BONE LESIONS IN PATIENTS OF TWELVE OR OVER

Author	Date	Patient	Lesions	Onset	Additional Findings
Levy-Bing and Duroeux[41]	1913	Girl of 19	Multiple hyperperiostitis of long bones	At age 12	
Mouchet and Meaux-St. Marc[51]	1913	Woman of 24	Swollen and painful right elbow	Traumatic few weeks.	Other stigmata.
Mouchet and Meaux-St. Marc[51]	1913	Man of 20	Swollen and painful wrists. Suppurative osteitis	Recent trauma	Previously had an osteomyelitis of the ankle.
Sequeira[67]	1914	Boy of 16 Girl of 12	Osseous syphilis of the nose	Recent trauma	
Pinard[57]	1921	Man of 78	Clavicular gumma	At age 73	Other stigmata of heredosyphilis.
Antonin[4]	1922	Woman of 30	"Recurring evidence of bone syphilis"	Traumatic at age 7	
Spackman[68]	1922	Boy of 16	Small stature		Abdomen distended with fluid. Liver-spleen large.
Spence and Tittle[69]	1923	Boy of 15	Ankylosed elbow, ulcer at sternoclavicular joint. Sore and painful joints		Ascites and marked anemia.
Steinmetz[71]	1923	Man of 32	Large thick femora and tibiae. Osteomyelitis and periostitis	At age 23	Positive blood Wassermann.
Roederer[61]	1923	Boy of 17	Osteoporosis with medullary gumma	Traumatic at 4 and recurred 14	Positive blood Wassermann.
Bowman[12]	1923	Man of 29	Involvement of left wrist and ankle		Hutchinsonian incisors and atrophic shoulder.
Yampolsky[88]	1923	Boy of 12	Large elbow and a Charcot joint	Traumatic	Positive blood Wassermann after treatment.
Menninger[48]	1926	Man of 22	Osteoporosis of the skull. Giantism.		Dental stigma. Bosses. Submental development.
Rouillard and Calmels[64]	1926	Woman of 44	Multiple osteoarthropathies. Polyarthritis.	Duration 4 years	Positive blood Wassermann.
Meurisse[49]	1927	Woman of 23	Joints of knees—hips		Facial and dental stigma. Positive blood Wassermann.
Laroche and Barthes[40]	1927	Woman of 20	Numerous bones involved "pleonosteose"		Positive blood Wassermann.

a rarity of occurrence past thirty. Bone stigmata of tardive heredosyphilis are in the main the result of osteitis and ossifying periostitis in the earlier months of life, which produce the diffused thickening and exostoses observed. Syphilitic bone disease in early adolescence and early adult life appears almost constantly in association with trauma (see Table 1), giving additional evidence of the predilection of this process for the vulnerable portions of the extremities.

PATHOLOGY

The earliest work on the pathology of congenital bone syphilis is that of Wegner, with additional contributions by Parrot. In 1922 Holland[79] published an excellent article on the bone changes found in congenital syphilis. His findings are very similar to those described by Wegner. They describe the predominant lesion as being osteochondritis and divide the findings into three stages depending upon the severity of the process.

First Stage. The zone of temporary calcification which represents the limit of advancing ossification at the ends of the diaphyses is increased in thickness. The cartilage cells continue to proliferate in the adjacent zone epiphyses, there being no cessation of the normal changes except a retardation of the ossification process. This results in the yellow zone of temporary calcification becoming abnormally wide, and it may measure as much as 2 or more millimeters in width. Holland states that "in early lesions there may be no recognizable abnormality." When this is true it is difficult to recognize the changes by the microscope unless spirochetes can be demonstrated.

Ossification of the zone of temporary calcification may be checked except around some of the large vertical vessels which unite the diaphysis and epiphysis. When this occurs the diaphyseal border of the zone of temporary calcification becomes notched and serrated. Wegner states that this zone has a pinkish white, glistening appearance and is very brittle.

Second Stage. The process is much more evident. The cartilage cells continue to proliferate, and there is an increase in the calcification of the intercellular matrix. The ossification is still retarded. Holland's description of this stage is quoted in its entirety.

> Owing to curtailment of the normal vascular supply, portions of the epiphyseal cartilage may become degenerate and not undergo provisional calcification and subsequent ossification. The vertical vessels, however, which unite the cartilage with the diaphysis are relatively large vessels, and the blood supply from these are less likely to be cut off. Provisional calcification and subsequent ossification usually proceed, therefore around some, at any rate, of these.
>
> In consequence, narrow processes, or broader tongues, of red marrow project from the diaphysis into the epiphyseal cartilage and alternate with tongues of cartilage which project into the diaphysis. The line of junction of the epiphysis with the diaphysis then appears dentate, and the zone of provisional calcification follows the irregular line of interlocking teeth.
>
> Further, as growth proceeds the level at which provisional calcification should normally take place may reach transverse chondral vessels of which the blood supply has not been interfered with. Around these vessels, in the epiphysis beyond the degenerate portions of cartilage, calcification, and subsequent ossification take place in due course. This leads to the occurrence, in the epiphyseal cartilage at a distance from the main epiphyseal limit of diaphyses, of red streaks and dots which are each bordered by a narrow zone of yellow calcification. Transverse chondral vessels have become visible to the naked eye, and moreover have become surrounded by a visible zone of calcification. Now, not only is the junction of the diaphysis with the epiphysis dentate but transverse zones of provisional calcification are seen at different levels. The disturbance of the normal pattern is extreme.
>
> The cartilage lying upon the deepened zone of provisional calcification may not be interrupted by vertical vessels surrounded by

provisional calcification. Then calcification preparatory for ossification commences in the cartilage about a transverse vascular arch at the time it should normally appear at this arch. When this takes place two zones of provisional calcification separated by a zone of cartilage are seen. Ossification may then proceed toward the epiphysis from this transverse vascular arch. In this way a more remarkable appearance is produced—a yellow, usually irregular line of provisional calcification is followed by a zone of red marrow, in which osseous trabeculae can be felt with the point of the scalpel, and this red marrow is separated from the red diaphyses by a second—the original, yellow, abnormally deep—zone of provisional calcification.

This zone has a bluish transparent color, very soft consistency and cuts like gelatin. Wegner compares this stage to rickets.

Third Stage. There is a further progression of the osteochondritis and in addition diaphysitis and epiphysitis.

The changes seen in the second stage become more pronounced and there is now definite evidence of fibrosis. In advanced inflammations the fibrosis is followed by a development of a dense granulation tissue. This granulation tissue causes necrosis and absorption of bone which when present proximal to the zone of temporary calcification causes a weakening of the area and it may result in an infraction of the diaphysis which results in a condition called by Parrot, pseudo-paralysis. Wegner states that after granulation tissue has replaced the normal vasculature there may be actual pus formation.

This process may be distributed throughout the diaphysis and similar changes may result. When the diaphysis is involved, frequently the process extends to the periosteum. Most observers believe that the changes in the bones are due to the presence of the spirochetes or their toxins. Fortunately for the roentgenologist, the spirochetes seem to have a predilection for the bones probably because of their rich blood supply.

Summary of the Pathological Changes.

(*a*) Abnormal cartilage cell proliferation which causes slight swelling of the epiphysis.

(*b*) Widening of the zone of temporary calcification, with occurrence of secondary zones of calcification.

(*c*) Retardation of the transference of calcified cartilage.

(*d*) Fibrosis and granulation tissue, with subsequent necrosis in the marrow at the diaphyso-epiphyseal junction, which causes weakening of the bone at this point, with possible subsequent infraction of the diaphysis (or the so-called epiphyseal separation).

(*e*) The outermost cells near the perichondrium are more regular and the calcified zone is more regular than near the center.

(*f*) The chondral and vascular canals are enlarged, the vessels are few and irregular.

Virchow[82] called rickets "parenchymatous bone inflammation." Wegner called congenital syphilis "osteochondritis" or "cartilage inflammation." In rickets, there is increased vascularization of the tissues with diminished calcification; in syphilis there is diminished vascularization and increased calcification which may be general. Holland says:

> Focal areas of syphilitic inflammation occur with considerable frequency in the medulla of the diaphysis at a distance from the epiphysis. This fibrosis is associated first with cessation of deposit of bone and later with erosion of trabeculae of bone and calcified cartilage present. In early stages the areas of fibrosis are seen by the naked eye as paler, pink areas in the red marrow of the diaphysis, in later stages the granulation tissue is slaty blue or yellowish, frequently gelatinous, and the affected area feels soft.

Parrot emphasizes the existence and the importance of the osteophyte in the histogenesis of the process. He epitomizes the stages as a primary periosteogenesis with a formation of osseous tissue from the periosteum, followed by a calcareous incrustation of cartilage with subsequent gelatinous transformation and softening of the bone. The lesion, primarily syphilitic,

later has more resemblance to rachitis. Waldeyer and Kobner[84] in a study of 12 cases confirmed the histology of Wegner. They concluded, however, that not all the phenomena occurring between the epiphysis and diaphysis were due to an osteochondritis but rather to formation of syphilitic granulations comparable to gummatous tissue, and the soft tissue between the bone and cartilage was compared to embryonal tissue.

Herxheimer,[30] writing in 1907, emphasizes the major points brought out by Wegner a generation previous. Ware,[85] from his roentgen studies of syphilitic long bones, concludes that acquired or hereditary cases are similar and in their development start with a circumferential thickening of the periosteum, resulting in an increased diameter and finally the appearance of gummatous deposits together with a lengthening and bowing of the bone. Karsner,[35] in 1910, using the femur of a still-born child, demonstrated an irregular yellowish line at the epiphyso-diaphyseal junction at the lower end of the femur (Wegner's line), which he pointed out was not fatty degeneration but represented a similar excess of connective tissue as seen elsewhere in such processes.

MacCallum[44] confirms Wegner's osteochondritis as the most definite and characteristic lesion found practically always in syphilitic new-born infants. The process is most distinctly developed at the epiphyseal ends of the long bones about the knee. The normally thin, even and pearly-gray epiphyseal line becomes thick and jagged and assumes an opaque yellowish-white color. Microscopically, a layer of granulation tissue forms (essentially gummatous) along the side of the bone which becomes prone to necrosis and disintegration. This involves the most recently formed bone, and the delay in the process of bone formation ultimately results in a débris of minute bony fragments. New growth comes from the periosteum and perichondrium.

Thus far we have dealt exclusively with early bone lesions in congenital syphilis without mention of the variant pathological types seen in the later heredo-type—the syphilis hereditaria tarda. This latter group of cases may have features suggestive of acquired bone syphilis and in most instances shows evidence of a bone involvement early in childhood—the usual osteochondritis and periostitis. Dennie's conclusion from a series of 50 cases of congenital bone syphilis is that the periostitis of the long bone is comparable to the acquired type. His most typical pathological finding in late hereditary syphilis is a proliferative thickening of the cortex with a relatively narrowed medulla as a result of the encroachment. A coincidental deposition of lime salts in the Haversian canals and in the lymphatic spaces produces a bone of ivory-like hardness. Blood vessels and lymphatics are cut off with diseased portions and either absorbed or cast out as sequestra. An osteomyelitis may follow if secondary infection ensues. A local interference with the blood supply just beneath the periosteum by a deposit of connective tissue or new bone cells in the Haversian system will result in a subperiosteal gumma.

Sutherland and Mitchell[74] suggest that the bone lesions of congenital syphilis are found in the secondary stage of the disease mainly because of their ephemeral characteristics. The older the child, the fewer the bones that are affected.

Most pathologists, of which MacCallum is one, believe that the bone lesions in the tardive type of heredosyphilis are similar to the tertiary manifestations found in acquired syphilis. It is difficult to comprehend how changes could lie dormant for such a long time and become so definite without there being some exciting cause such as trauma. The usual syphilitic affections involving the bone in the tardive type is as follows according to MacCallum:

1. "Periosteal gumma formation with necrosis of the underlying bone, followed by ulceration and exposure through the skin or by extensive osteophyte growth."

It is thought by some that the periosteal inflammation may form a part of the secondary stage of syphilis, but there has been no proof of the contention.

Essentially it seems that the periosteum is involved first. This is separated from the bone by the inflammatory infiltration composed chiefly of mononuclear wandering cells. Following the rupture of the periosteum the skin may break down and the underlying tissues are subject to further infections. This may lead to:

2. Gummatous osteitis or osteomyelitis with necrosis and erosion of the directly affected part and rarefaction or sclerosis of the surrounding bone." A new growth of spongy bone may be produced on the surface of the old cortex, forming in this way a convex surface, or osteomyelitis which can be felt as elevations. There is another form of new production of bone which is not limited to the activity of the periosteum. The Haversian system and the cancellous bone of the interior are usually the sites of the process. The bone becomes dense and hard.

"Still another type and possibly more characteristic are the gummatous lesions which arise in the periosteum or the interior of the bone. In the first place the gummatous tissue may extend along the blood vessels into the bone enlarging their canals and eroding the bone to a peculiar wormeaten appearance and in untreated cases the bone may be entirely destroyed." Osteophytes surround the area which make it seem deeper. In all of these processes there is evidence of rarefaction or bone destruction and condensation or sclerosis due to bone production.

Gummas found in the marrow exist as gelatinous patches, often bright yellow from their content of fat. They may occur frequently enough to become almost continuous. The process may attack the cortex and subsequently cause the periosteum to lay down even bone. This causes a spindle-shaped dilatation of the bone. Canals or fistulae are formed through the cortex and except for the absence of sequestra, the bone comes to look like the end-result of an ordinary osteomyelitis.

The joints, bursae and tendon sheaths often reveal a susceptibility to syphilis. There may be an accumulation of a watery exudate or the formation of a syphilitic granulation tissue in the synovial membrane. This may ulcerate and cause a great proliferation of the adjacent unaffected membrane and synovial villi. This joint affection no doubt is secondary frequently to the appearance of gummatous infiltration of the epiphysis.

This process often destroys the cartilage and after a long time may heal by obliteration of the cavity by fibrous tissue.

Charcot's joints or tabetic arthropathies were originally described as being due to trophic disturbances. Kienböck,[36] however, feels that the process follows fractures which result from complete analgesia and the rarefaction of the bone so that even a slight strain may break off a part of the bone. Kienböck described two forms, hypertrophic and atrophic. The hypertrophic form is due to tears and fractures with hemorrhage into the stretched joint cavity. In the atrophic form there is no attempt at healing, atrophy being the outstanding finding.

CLASSIFICATION

Several groupings may be made in the attempt to classify the variety of bone lesions of both congenital syphilis and late heredosyphilis. A catalogue of bone lesions based on pathology alone is inadequate, as a working classification should include likewise factors of incidence, age and involvement. Abt has grouped the bone and joint lesions as follows:

1. Periostitis. Between the ages of 5–12 years
2. Gummatous periostitis
3. Gummatous osteomyelitis. A late occurrence in heredosyphilis.
4. Arthritis { prominent frontals / prominent laterals

5. Cranial involvement { asymmetrical prominences; hydro- and microcephalus }

Gaucher's[27] classification, 1911:

1. Osteoarthritis hypertrophic
2. Exostoses, multiple
3. Gummatous osteitis and periostitis
4. Suppurative osteomyelitis { spina ventosa syphilitica; mal de Paget syphilitica }
5. Epiphyseal osteitis "tumeur blanche" (hypertrophic osteitis infancy to adult. Knees and ankles. Ankylosis)
6. Arthraglia

Fitzwilliams' classification:[24]

1. Syphilitic "epiphysitis" (perichondritis)
2. Syphilitic dactylitis at 2–3 years of age. Rare
3. Periostitis—most common
   a. Local—generally long bone, i.e., tibia following trauma—commences at 6 years
4. Syphilitic osteomyelitis (gummatous replacement)

Broca, in discussing the tardive type of heredosyphilis, grouped his cases into circumscribed osseous gummata, particularly at the elbow and the knee, osteomyelitis gummosa diffusa (sabre shin, involvement of the upper facial bones, and infantilism).

As a classification for all types of congenital syphilitic bone disease, Dennie divides his cases as follows:

1. Productive periostitis—long bones } In the new-born
2. Syphilitic disease of the epiphyses } In the new-born
3. Bursitis
4. Periarticular infiltration
5. Syphilitic epiphysitis, i.e., the knee
6. Osteitic periostitis—long bones. Going on to possible
   a. Secondary osteomyelitis or
   b. Subperiosteal gumma
7. Syphilis of the skull { hyperplastic osteitis (bosses); osteoporosis }
8. Dactylitis—before the 3rd year

ROENTGENOLOGIC CLASSIFICATION OF EARLY CASES OF CONGENITAL BONE SYPHILIS

We have found the following classification satisfactory and descriptive.

1. Epiphysitis—3 stages: first, second and third, all epiphyses including carpal and tarsal bones.
2. Osteochondritis—3 stages. All bones.
3. Diaphysitis—all bones: rarefying osteomyelitis, condensing osteomyelitis, and combination of the two processes.
4. Periostitis.

ROENTGENOLOGIC CLASSIFICATION OF TARDIVE HEREDOSYPHILIS

1. Synovitis and periarticular infiltration.
2. Hypertrophic and atrophic changes in the joints with or without loose bodies.
3. Diaphysitis—all bones, rarefying osteomyelitis (generalized, localized), rarefying osteitis localized (gumma), condensing osteomyelitis.
4. Periostitis—all bones, Parrot's node-skull, dactylitis.
5. Unusual manifestations (osteitis fibrosa cystica).

DIAGNOSIS

Late bone manifestations, occurring most frequently between the fifth and the twelfth year, involves the tibia and elbow with greatest frequency. Multiple bone involvement is more often seen with joint changes usually secondary. While in infancy, osteoperiostitis, when it occurs, is found as a generalized lesion affecting mainly the ends of the long bones, the tendency in later childhood is involvement principally or solely of the shaft. Here, injury plays an increasingly important part in the bone selectivity directly proportional to the age of the child.

The onset is gradual and generally accompanied by pain (worse at night) often described by the parent subsequently as "rheumatic" or "growing pains." Weber has called attention to the absence or but relatively slight pain that is seen in some

instances. A symmetrical and tender swelling ensues with functional disability proportionate to the pain or the proximity to the joint. Subsidence of the acute process may be followed by a secondary osteomyelitis or gummatous ulceration, but more commonly the typical bone deformities develop, ranging from but slight roentgen changes to the markedly bowed and thickened sabre tibiae. The less common gummata, osteoporosis, and Charcot joint changes are recognized and diagnosed exactly as in the acquired form of the disease.

Additional evidence of heredosyphilis may often be the deciding factor in the early recognition of minor bone changes (i.e., eyes, facies, teeth), and while the complement fixation test is a valuable adjunct in children it tends to be of considerably less value in the older patient (Stokes and Dennie).

By far the most exacting and the ultimate in diagnostic criteria are the changes seen in the roentgen examinations of the bones. The value lies less in the clinically recognizable case than in the absence of obvious bone changes in which typical and consistent changes are demonstrable only on roentgen examination, and often constitute the sole clue to diagnosis.

No attempt will be made to describe the roentgen findings in the early cases of congenital syphilis as these have been fully described in an article by Pendergrass and Bromer.

SYNOVITIS AND PERIARTICULAR INFILTRATION

Clutton[15] described this condition in 1886. Subsequently Churchman[14] in an excellent article reviewed the literature and added one of his cases to Verneuil's original group, making a total of 26 cases up to 1909. He described the pathology as: (*a*) luetic bursopathy secondary to luetic arthropathies (luetic syphilis with swelling); (*b*) luetic bursopathy independent of any joint involvement. There are three types: (1) congestive bursitis, (2) hydrops, and (3) gumma of the bursa.

The diagnosis is dependent upon:

(*a*) Presence of constitutional syphilis.

(*b*) Spontaneous development independent of trauma.

(*c*) Slow evolution and chronicity.

(*d*) Marked absence of pain, tenderness, or functional disability.

(*e*) Symmetry of bursopathies.

(*f*) Usual sites are knees and elbows.

(*g*) Absence of joint involvement.

(*h*) Response to specific treatment.

Clutton's joints of congenital lues are exactly similar clinically to luetic bursopathy or Fournier's "pseudo-tumeur blanche syphilitique." Coues[17] and Lane[38, 39] have described this condition and have added several cases.

The chronic synovitis and periarticular infiltration found in hereditary syphilis frequently manifests itself as a symmetrical chronic synovitis of the knees, "false tumor albus," exceedingly resistant in character according to Jones and Lovett.[34] The joints may be painful and slightly tender to pressure. In one case a number of the joints were affected and some had progressed into the stage that is very similar to the tertiary stage of acquired syphilis described by Jones and Lovett. The roentgen findings are not typical, but do show some periarticular swelling and possibly some effusion into the joint evidenced by an elevation of the patella. According to Jones and Lovett:

> The essential pathology results from a chronic inflammation produced by a periarterial invasion by the Treponema pallidum. A proliferation of fixed cells and an inflammation with small lymphoid cells and plasma cells most frequently involves the periarterial tissues and the walls of the nutrient arteries. The adventitia is the common initial focus of this lesion which develops into a small nodule, destroys the elastic tissue of the media, and produces proliferation of the intima with subsequent narrowing of the lumen. For this reason the blood supply is diminished and coalescence of adjacent granulomata favor degen-

eration and necrosis which result principally from occlusion and thrombosis in the capillaries and involvement of the vasovasorum in the larger arteries.

HYPERTROPHIC AND ATROPHIC CHANGES IN THE JOINTS, WITH OR WITHOUT LOOSE BODIES

In most cases one does not find any cartilaginous changes in the joints nor any evidence of hypertrophic changes. Baetjer and Waters[10] state that when such changes occur they can be regarded as evidence of some lesion other than lues. These authors also call attention to a new bone formation

FIG. 1. Rarefying and condensing osteomyelitis of the skull.

which occurs at the chondroperiosteal junction. This new bone formation with the periarticular swelling is thought to be characteristic of lues.

When extensive changes occur in the joint it is usually due to an extension from a primary gummatous process in the cancellous bone adjacent to the joint.

DIAPHYSITIS

Several types of diaphysitis can be recognized on the roentgenogram: (1) rarefying and condensing osteomyelitis (generalized or localized) (see Fig. 1); (2) condensing osteomyelitis (see Figs. 2 and 3); (3) rarefying localized osteomyelitis. Luetic osteomyelitis may have the same appearance as any other type of infectious osteomyelitis (see Figs. 23 and 24). There may be an irregular density of the bone, with sequestration, and there may or may not be draining sinuses.

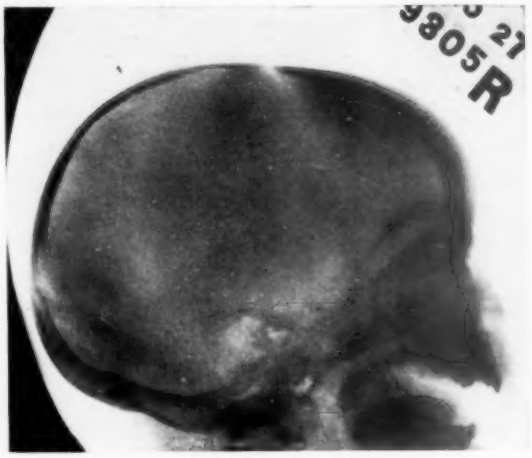

FIG. 2. Condensing osteitis in boy aged six years. (Illustration loaned by Dr. R. S. Bromer.)

The localized type of diaphysitis or osteomyelitis has been recognized for years and was considered as an important sign in diagnosis long before roentgenograms were made (see Figs. 4 and 5). These localized areas are frequently found on the

FIG. 3. Condensing osteitis of the skull in a boy eight years of age. (Illustration loaned by Dr. R. S. Bromer.)

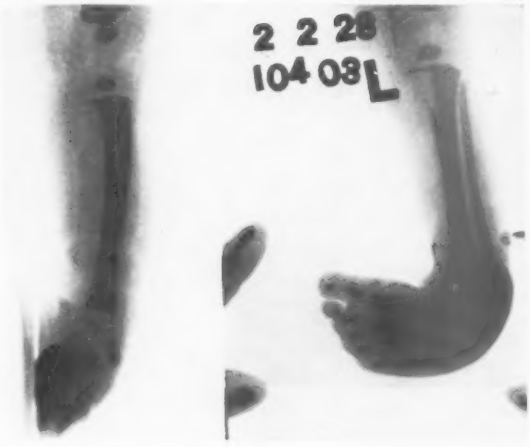

Fig. 4. Localized diaphysitis (punched-out area) adjacent to the diaphyso-epiphyseal junction. Note the preservation of the zone of temporary calcification. (Illustration loaned by Dr. R. S. Bromer.)

tibia but may be found on any bone. The roentgen appearance is that of a localized area of bone destruction surrounded by dense eburnated bone.

The roentgen appearance of the second type of osteomyelitis is that of a widened and thickened shaft. The coarse trabeculation of the bone and thickened cortex is probably a later stage of the process described above. Lues with multiple gumma formation causes bone destruction of some of the bone trabeculae in the center of the shaft, and this is surrounded by much formative activity, and ultimately the bone may become so dense that it is difficult to distingiush bone trabeculae in the ordinary roentgenogram.

Osteomyelitis or diaphysitis is nearly always associated with periostitis.

Rarefying osteitis is recognized on the roentgenogram as a localized area of bone destruction adjacent to the diaphyso-epiphyseal junction. This lesion is rather typical and almost diagnostic, although it may be confused with localized osteomyelitis of some other type of infection (see Fig. 6).

Fig. 5. Same case after treatment.

Fig. 6. Localized area of infective osteomyelitis adjacent to the diaphyso-epiphyseal junction. Note the destruction of the zone of temporary calcification. Compare with Figure 5 which is a case of congenital syphilis. These two can usually be differentiated clinically. (Illustration loaned by Dr. R. S. Bromer.)

PERIOSTITIS

Periostitis may be localized or generalized, and, as stated above, it usually accompanies diaphysitis, but it may occu

alone. In the early stages of periostitis the diagnosis is fairly easy to make as the periosteal new bone formation is usually laid down perpendicular to the long axis of the bone (see Fig. 11). One must be careful to remember that this appearance should be differentiated from the perpendicular striation of osteogenic sarcoma. In ordinary osteomyelitis the periosteal new bone is laid down parallel to the shaft.

We have been unable to find any explanation for the perpendicular periosteal new bone formation in syphilis. It is assumed therefore that ossification of bone proceeds around the larger vertical periosteal vessels entering the cortex in which the blood supply has not been interfered with. Dactylitis or periostitis of the bones of the hands and feet is an exception to this rule. In these areas, the bone is laid down parallel to the shaft. Parrot's node is a small osteophyte which is due to periosteal activity in the skull.

The unusual manifestations of bone pathology in syphilis are the occurrence of osteitis fibrosa cystica, bone cyst or bone cavity as described by Stoloff. The roentgen appearance is a localized area of bone destruction with some expansion of the cortex. The cyst may be lobulated or locuated and is usually situated at the end of the diaphysis. Pommer and Looser[58] feel that these areas are an expression of bone trauma, hemorrhage occurring at the time of the trauma with subsequent bone atrophy. Ironside[33] has reported a case of congenital syphilis in which von Recklinghausen's disease or osteitis fibrosa cystica has been observed. Barrie[6] has written an excellent article on the association of these lesions.

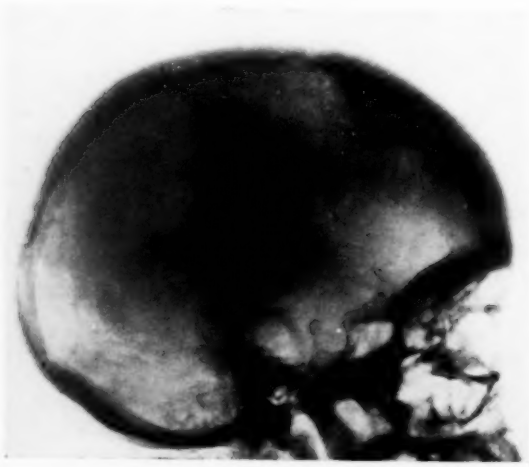

FIG. 7. Condensing type of osteitis in skull. No areas of rarefaction could be demonstrated.

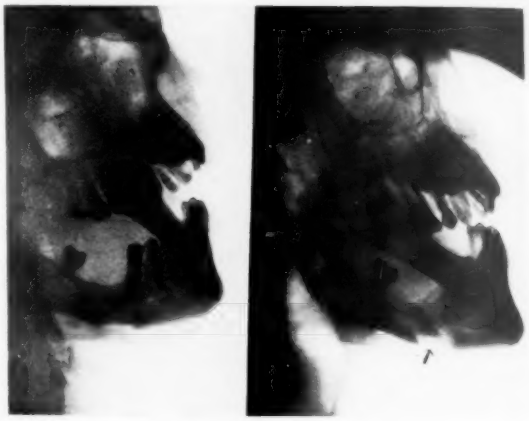

FIG. 8. In the illustration on the right the area of luetic osteomyelitis with sequestrum formation can be easily seen. The illustration on the left shows the same jaw after treatment was instituted. The bone has now assumed a normal appearance.

REPORT OF A CASE

T., male, aged twenty-five, was first seen in the out-patient service on Oct. 27, 1927, complaining chiefly of an open sore on the arm, and an abscess of the jaw (see Fig. 26).

Two years previously the patient had had a tooth extracted because of malposition. Later, a second extraction resulted in an abscess from which sequestra have appeared at intervals. For the past month the right knee has been swollen but not painful and for the past two weeks he has had an open sore on the right arm which has discharged pus.

At the age of five he was kicked by a horse and since then has had a painless lump in his abdomen which has increased slightly in size. At the age of six, his mother noticed that he was "sleepy-like". At the age of fifteen, his legs hurt him and he was regarded as "rheumatic". There was no further trouble until just prior to his present chief complaint. No

other traumatic history was elicited other than the kick from the horse and his later dental extractions.

Family History. His father died at the age of sixty-three with cirrhosis of the liver. His mother, aged sixty-seven, is at present under treatment for cardiovascular syphilis. His mother's pregnancies have been as follows:

1. Son, who grew to maturity and was killed in an accident.
2. Miscarriage at four months.
3. Daughter, living and well, with a negative blood Wassermann.
4. Son, in a government hospital for the insane.
5. Son, grew to maturity, killed in an accident.
6. Son, living and well, with a negative blood Wassermann.
7. Stillbirth.
8. Thomas, our patient.
9. Miscarriage at four and one-half months.
10. A son in the army, with a negative blood Wassermann.

Fig. 9. Appearance suggests beginning osteitis fibrosa cystica. This appearance may be found in the ends of the long bones when the luetic process has progressed for some time.

Of the above, we have seen and examined only the daughter (No. 3), who we believe is free from syphilis.

Social History. The patient completed the fifth grade at the age of thirteen and since that time has stayed at home (recluse), with no apparent interests. There has been no history of conduct disorder but rather arrested mental development. (At a subsequent examination his mental age was determined as nine years and three months.)

Examination. The significant findings included a markedly enlarged liver and spleen, which extended down to the anterior superior iliac spine and mesially to within 4 inches of the umbilicus. A large indolent ulceration was found over the lower portion of the right humerus and the left tibia, with exposure of the bone, and a swollen right knee. The patient presented the appearance of a freckle-faced, serious-miened adult, with a boy's build. (He weighed 90 lbs. and was 59 inches tall.) (Fig. 26.) The lower right jaw was swollen and misshapen, the teeth in poor condition, and there was a distinct clouding of the right cornea.

Laboratory. Oct. 27, 1927. Hemoglobin, 50 per cent; erythrocytes, 2,900,000; leucocytes, 5,800; Kolmer Wassermann reaction, 2+, Kahn, 3+, spinal fluid examination, negative; blood urea, 13 mg. per 100 c.c.; urine, negative except for a very faint trace of albumin.

Further cytological studies showed on: Nov. 2, 1927, hemoglobin, 50 per cent; leucocytes, 3,800; Nov. 21, 1927, hemoglobin, 40 per cent; erythrocytes, 2,800,000; leucocytes, 3,800; differential count: polymorphonuclear neutrophiles, 61 per cent; small lymphocytes, 33 per cent; large lymphocytes, 5 per cent; large mononuclears, 1 per cent.

Special Examinations:

Dental. Several cavities and malposition of teeth in the upper jaw. No extractions indicated at present.

Orthopedic. Advised no tapping nor splinting of knee-joint until after considerable specific treatment.

Nose and Throat. Both faucial tonsils contain pus. Much purulent material in each nostril. Both maxillary sinuses are dark to transmitted light, and frontal sinuses transmit

FIG. 10. There is an extensive involvement of the joint which has probably resulted because of an extension of the process from the lower end of the humerus.

light poorly, possibly because of their small size. The ears are negative.

Roentgen Examination. Head: The bones of the vault show considerable increased density. There is very little if any rarefaction and the bones of the vault are much thicker than normal. The findings are rather typical of the condensing type of osteitis seen in some cases of congenital lues (see Fig. 7).

Lower jaw: The left lower jaw is negative.

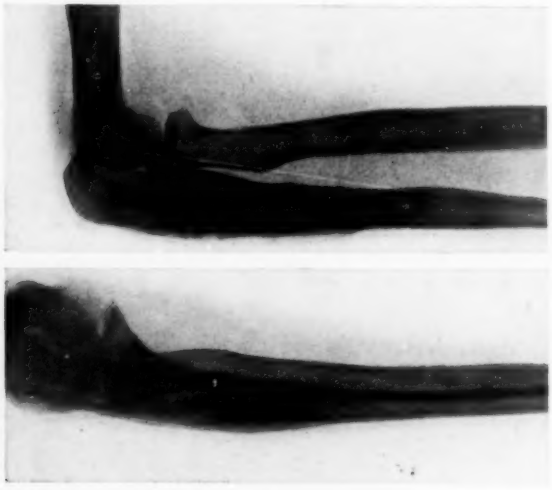

FIG. 11. Before treatment.

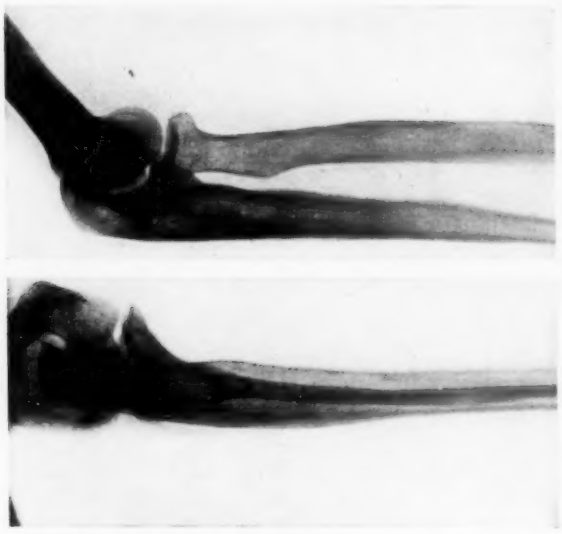

FIG. 12. After treatment.

There is a localized area of osteomyelitis in the right lower jaw. In the center of the rarefied area, there is a small area of increased density very suggestive of a sequestrum. Note the absence of any periosteal reaction or formative activity at the periphery of the diseased area (see Fig. 8).

Shoulders: There is an area in the upper end of the right humerus that suggests beginning changes of osteitis fibrosa cystica. In the left humerus the changes are more marked and extend almost to the articular surface. The

FIG. 13. End-result.

findings are rather typical of osteitis fibrosa cystica (see Fig. 9).

Elbows: Considerable atrophic and hypertrophic changes in the right elbow. The disease process (gumma) in the lower end of the humerus and the upper end of the ulna probably has extended into the joint and caused the destructive process which is seen (see Fig. 10). The articular surfaces of the left elbow seem to be intact. There is an advanced osteomyelitis of the upper end of the ulna with an irregular area of rarefaction and condensation. Periostitis on the posterior aspect of the ulna is rather typical. Note the perpendicular striation (see Figs. 11, 12 and 13).

Chest: Negative.

Abdomen: There is an enlarged liver and spleen.

Spine: Negative.

Pelvis and Hips: There is an area suggesting gumma formation just above the acetabulum on both sides, especially the right, the roentgen evidence being rarefaction (see Figs. 14 and 15). The left hip joint is negative. The right hip joint shows some destruction of the cartilage and considerable hypertrophic changes with loose body formation. There is marked coxa vara. The changes in this joint are probably due to extension of the disease process from the upper end of the right femur into the joint. The greater trochanter of the left femur shows an area of rarefaction suggesting a localized area of luetic osteomyelitis. The entire right femur shows an advanced type of condensing and rarefying osteomyelitis with sequestrum and gumma formation. The shaft is considerably widened with thickening of the cortex due to periosteal proliferation (Fig. 16).

Fig. 14. Before treatment.

Fig. 15. After treatment.

Knees: The examination of the right knee shows marked periarticular swelling and effusion. There has been some destruction of the articular cartilage indicated by the close approximation of the joint surfaces. There is a slight tendency toward loose body formation (Figs. 17, 18, 19 and 20). The lower end of the femur and the upper end of the tibia show areas of multiple gumma formation evidenced by the areas of irregular rarefaction. The examination of the left knee shows very little change in the articular surfaces, but does show multiple areas of rarefaction and increased density adjacent to the joint surfaces possibly due to multiple gumma formation. There is a large cyst-like area in the inner aspect of the lower end of the femur probably due to osteitis fibrosa cystica (Figs. 21 and 22).

Legs: The tibiae showed evidence of diaphysitis, the changes being irregular areas of rarefaction and increased density with some widening of the shaft (Figs. 23 and 24). The left tibia had the typical textbook periosteal gumma. We have termed this lesion localized

FIG. 16.

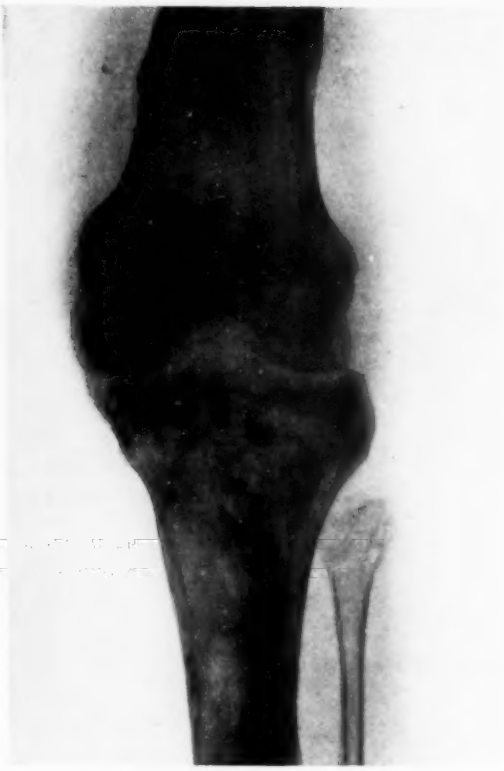

FIG. 17. Anteroposterior view.

FIG. 18. Lateral view before treatment.

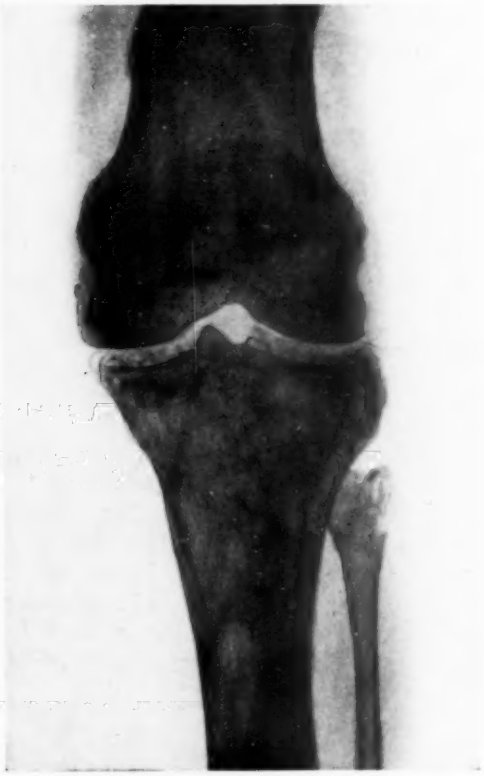

FIG. 19. Anteroposterior view after treatment.

Fig. 20. Lateral view after treatment.

Fig. 21. Anteroposterior view.

Fig. 22. Lateral view.

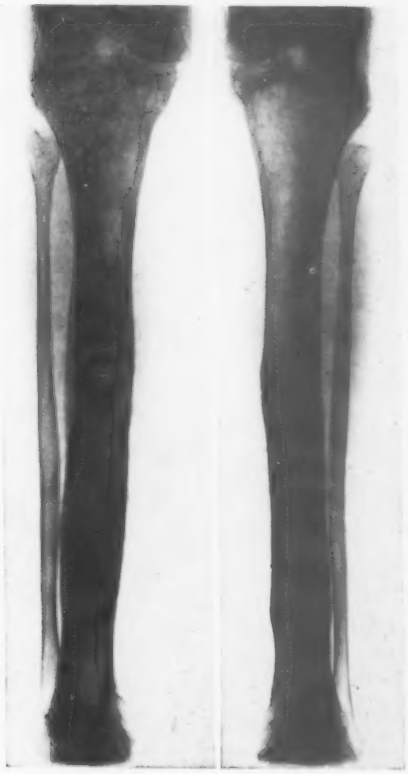

Fig. 23. Anteroposterior view of both legs.

FIG. 24. Lateral view of right leg.

diaphysitis as all the changes are in the cortex, there being little if any periosteal change (Fig. 25).

Feet: Negative.

Treatment. Nov. 9 to Dec. 16. Seven injections of potassium bismuth tartrate, a total of 1 gram. At the same time he received daily intravenous injections of sodium iodide, most of the time the maximum dose of 100 c.c. of a 10 per cent solution being employed.

Dec. 17 to Mar. 10, 1928. He received 12 intravenous injections of neoarsphenamine—an average of 0.6 gm. per dose.

Mar. 17 to May 25. He received 10 weekly injections of potassium bismuth tartrate, a total of 1.8 gm.

May 28 to Aug. 4. He received 8 intravenous injections of neoarsphenamine, averaging 0.45 gm.

Aug. 11 to Oct. 17. He received 10 injections of potassium bismuth tartrate—a total of 1.8 gm. Throughout at intervals he has also taken potassium iodide by mouth up to the present time.

Progress. Dec. 24, 1927. There has been a gain in weight of 18 lbs. and the spleen and liver are much reduced in size. Cutaneous lesions are 50 per cent involuted.

Jan. 21, 1928. In excellent condition, with a total gain of 30 lbs.

Feb. 28, 1928. Surgical consultation gave the opinion that the osteomyelitis had a marked pyogenic factor and recommended curettement of the cavity, which was done.

Roentgen Examination. There was considerable improvement in the appearance of all the bones previously examined.

May 28, 1928. Braces have been fitted.

Re-examination. Aug. 3, 1928. Dr. D. M. Pillsbury.

There are no subjective complaints, the appetite is excellent, bowels regular and no abdominal distress. Weight is 106 lbs. (59" tall), a gain over a year ago, but a loss from his weight in January of 14 lbs. His mental activity has been confined to reading the daily

FIG 25. The illustration on the left shows the lesion before treatment and the one on the right after treatment.

Fig. 26. Photograph of patient. The gumma on the left leg can be seen easily. Patient looks like a boy instead of a man.

paper. He is much more alert than formerly. He regrets his inability to continue school. His reactions are fairly quick, gesticulates freely, and speech comes readily, in fair grammatical construction. His exercise has been confined to walking four or five miles a day and his remaining diversions now include congregation with other individuals.

The pupils react to light and accommodation. There is a slight cloudiness over the right cornea. Ears are negative. Marked cavitation of the teeth is evident. Nose and throat are grossly negative.

There is a loud systolic murmur heard best over the aortic area with no widening of the aortic arch. There is a slight left ventricular enlargement. The lungs are negative but the chest is thickened in the anteroposterior diameter. The liver varies from 3 to 5 fingers' breadth below the costal margin. The spleen is still large, the dullness measuring approximately 10 by 20 cm.

There is no bony tenderness at any point. The shoulder girdle is negative. There are prominent cranial bosses. There is some enlargement of the upper left humerus. The left elbow and forearm appear normal. There is complete healing of the former ulcer at the right elbow. The joint has a range of movement of about 20 degrees and there is marked crepitus present. The knees are approximately equal in size with no apparent enlargement or pretermobility. There is marked thickening of the right tibia with moderate anterior bowing. There is an ulcer over the left tibia approximately 2 cm. in diameter but free from any inflammatory reaction.

Neurologically, the patient is normal. There is no malarticulation and the patient can retain seven digits by memory.

Roentgen Examination:

Head: The bones of the vault are less dense.

Right lower jaw: The area of osteomyelitis has entirely healed (Fig. 8).

Left shoulder: Very little change in appearance.

Right elbow: Very little change in appearance.

Left Elbow: Examination, Feb., 1928, showed considerable improvement in appearance. The periosteal proliferation has disappeared. The shaft of the ulna is smaller and the area of disuse has entirely disappeared (Fig. 12). The last examination, August, 1928, shows an almost normal appearance of the bone (Fig. 13).

Hips and pelvis: Both hips have improved in appearance. The joint surfaces are intact. The right hip still shows advanced hypertrophic changes, probably at the points of attachment of the capsule (Fig. 15).

Right knee: There has been marked improvement in appearance. Most of the periarticular swelling has disappeared, leaving only the hypertrophic changes which will probably remain. The appearance of the bone lesions in the femur and tibia show some healing indicated by the increased density of the bone surrounding the areas of rarefaction (Figs. 19 and 20).

Tibia: There has been considerable improvement in the appearance.

Subsequent History. On Oct. 12, 1928, the patient was re-admitted to the hospital in a markedly weakened condition. Prior to admission he had two severe hemorrhages by mouth, with black vomitus, and displayed a

marked yellowish pallor. The patient complained of thirst and inability to get enough air. A diagnosis of ruptured esophageal varices was made. His blood count was: Hemoglobin 14 per cent; red blood cells, 1,300,000; white blood cells, 13,700, with 81 per cent polymorphonuclears. There was likewise distinct anisocytosis and poikilocytosis. Following this, the patient had several transfusions and a paracentesis for an abdominal ascites. He was put on an Anderson diet and liver diet, also received novasural and sodium iodide. The blood count improved rapidly and his spleen was removed at operation. His surgical recovery was uneventful and by March he returned to the out-patient department for further treatment. He has since been given 20 weekly injections of bismarsen for a total amount of 3.9 grams. His last Kolmer Wassermann test was still strongly positive; his blood count on July 9, 1929, showed: Hemoglobin 90 per cent; red blood cells, 5,100,000; white blood cells, 7,100; polymorphonuclears, 67 per cent; lymphocytes, 27 per cent; large mononuclears, 4 per cent; eosinophiles, 2 per cent. His present weight is 106 pounds, while his general physical condition approximates that of a year ago.

ADDITIONAL CASES

Four additional reports from the literature are of interest in conjunction with our case. Spence and Tittle[69] reported the case of a white boy of fifteen who gave a history of blood vomiting followed by an increase in the size of his abdomen. Eight successive tappings were done. The spleen was not markedly enlarged but there was a severe secondary anemia with a hemoglobin of 38 per cent and a red count of 2,430,000. The joints were sore and painful and the general picture was one of marked malnutrition. There was an ulcer of the forehead and one at the sterno-clavicular junction. The elbow was ankylosed and the fingers swollen.

Spackman[68] in a series of 10 cases of late heredosyphilis described a boy of sixteen, small in stature, with an abdomen distended with fluid. Both the liver and spleen were greatly enlarged.

Nobécourt et al.[52] report a case of congenital syphilis with an autopsy report of the findings. The patient had an enlarged liver and involvement of a number of bones.

Acuña and Casaubon[2] reported the case of a boy of sixteen who had a chronic peritonitis associated with a recurring ascites. There were likewise skin and bone lesions.

DISCUSSION OF THE ROENTGEN FINDINGS

Almost every type of osseous syphilis that can occur was present in the case reported above. Dunham[22] has called attention to the infrequency of involvement of the bones of the skull. She reported 2 cases observed in 100 cases of congenital syphilis studied by her. We have observed this finding more frequently, and wish to stress the importance of the roentgen examination. Osseous syphilis may be present without giving any clinical manifestations. Menninger[17] concurs in this opinion. He describes the roentgen findings as osteoporosis. We believe that the most frequent finding in the late cases is that of condensing osteitis (Figs. 2, 3, and 7). A combination of osteoporosis and condensing osteitis seems to be found more frequently in the early cases (Fig. 1). The appearance of the bones of the vault in prenatal syphilis may sometimes closely resemble Paget's disease and one should be careful to keep this in mind. The tendency of the bone to form islands of increased density in Paget's disease should help to differentiate the two processes.

The occurrence of fibrocystic disease in the humerus and femur in our case (Figs. 9, 21 and 22) is very interesting in view of the fact that numerous authors, including Stoloff, Pommer and Looser, Ironside, Barrie, and Scott,[66] have attempted to show that fibrocystic disease or von Recklinghausen's disease in at least some cases is due to prenatal syphilis.

The joint lesions in our case show at least two stages. The types seen in the knees (Figs. 17 and 18) probably represent the form described by Clutton, namely, the bilateral painless hydrops due to inflammatory changes in the synovial membrane.

These changes were marked in both knees, especially the right. The changes found in the right hip (Fig. 16) simulate those described by von Gies.[83] The appearance of the joint suggests an early Charcot's joint, but we were unable to demonstrate any central nervous lesion. We think that the changes can be explained by the fact that the gummatous process in the upper end of the femur had extended to the joint. The extensive involvement of the neck of the femur has caused weakening of the bone with resulting coxa vera.

The changes occurring in the bones, which we have termed diaphysitis, are very similar to those seen in any *low grade osteomyelitis*. It has been interesting to note the marked degree of the changes in the tibia which more or less follows the dictum of Fournier who said, "Syphilis loves the tibia."

We have shown a number of illustrations demonstrating what we believe is the effect of treatment on the bone lesions. We are aware that it is believed by a number of observers that the bone lesions of syphilis may disappear without any treatment. Lindsey et al.[43] state the following: "We frequently have seen typical congenital luetics who upon admission to the clinic showed definite marked and extensive periostitis and who upon re-examination at a later date and, without having had any treatment are reported from the x-ray department as having no roentgen ray evidence of bone lesion and this in spite of cutaneous and other lesions present." We have not had this experience but we believe that it may occur, especially when it is kept in mind that bone lesions are supposed to be due to the local presence of the spirochetes or their toxins, and frequently, according to Harrison[60] and others, follow trauma. We cannot agree with Lindsey et al., that the lesions of late prenatal syphilis are almost never influenced by treatment. We have a number of cases similar to the one reported here that would support the premise that after treatment the bones tend to return to normal, and may actually form normal trabeculation. The periosteal changes disappear, the small areas of rarefaction are replaced by normal trabeculation. If the area of diseased density is large, it becomes surrounded by a zone of increased density, which gradually tends to replace the diseased area, and this area of increased density is in turn replaced by normal trabeculation. The sequestra are apparently absorbed as they disappear (Fig. 8). The joint surfaces seem to heal without new bone formation. When the peripheral bone is destroyed by gumma formation it does not fill in with normal bone after treatment. The scar always remains (Fig. 25).

SUMMARY

1. An unusual case of tardive heredosyphilis is reported. The patient had almost every possible type of bone involvement found in syphilis, all of which responded to treatment. The cutaneous mainifestations, and the involvement of the liver and spleen were interesting complications.

2. An attempt is made to describe the pathologic and roentgenologic appearances in heredosyphilis and correlate the findings.

3. The patient responded to antiluetic therapy and the change produced in the bones is described.

REFERENCES

1. Abt, I. A. Syphilis hereditaria tarda. *Wisconsin M. J.*, 1903–1904, *2*, 539–546.
2. Acuna, M., and Casaubon, A. Peritonite exsudative chronique par syphilis héréditaire. *Arch. de méd. d. enf.*, 1922, *25*, 257–267.
3. Addison, O. Syphilitic diseases of joints and bones in children. *West Lond. M. J.*, 1913, *18*, 85–91.
4. Antonin, P. La syphilis héréditaire tardive des os longs. *Marseille-méd.*, 1922, *59*, 164–167.
5. Apert, E. Syphilis héréditaire tardive. *Bull. Soc. anat. de Par.*, 1895, *70*, 645.
6. Barrie, G. Fibrocystic and cystic lesions in bones. *Ann. Surg.*, 1918, *67*, 354–363.
7. Barton, J. K. The Pathology and Treatment

of Syphilis, Chancroid Ulcers, and their Complications. Fannin & Co., Dublin, 1868.

8. HILL, BERKELEY. Syphilis and Local Contagious Disorders. J. Walton, Lond., 1868.
9. BERTIN, R.-J.-H. Traité de la maladie vénerienne, chez les enfans nouveau-nés, les femmes enceintes et les nourrices. Gabon, Paris, 1810.
10. BAETJER, F. H., and WATERS, C. A. Injuries and Diseases of the Bones and Joints. Paul B. Hoeber, New York, 1921.
11. BOUCHUT, E. Traité pratique des maladies des enfans nouveau-nés, des enfants à la mamelle et de la seconde enfance. Fourth edition. J.-B. Baillière & fils, Paris, 1861. Quoted by Barton, Hill and Diday.
12. BOWMAN, G. W. Syphilitic osteochondritis. *Urol. & Cutan. Rev.*, 1923, *27*, 273–277.
13. BROCA, A. Syphilis héréditaire des os et articulations. *Rev. prat. d'obst. et de paediat.*, 1913, *26*, 1; 33; 65; 97; 129.
14. CHURCHMAN, J. W. Luetic bursopathy of Verneuil. *Am. J. M. Sc.*, 1909, *138*, 371–396.
15. CLUTTON, H. H. Symmetrical synovitis of the knee in hereditary syphilis. *Lancet*, 1886, *1*, 391–393.
16. CORNIL, A.-V. Syphilis. Translation by Simes and White. H. C. Lea's Son & Co., Philadelphia, 1878.
17. COUES, W. P. Luetic bursopathy of Verneuil; report of a case of the congenital type. *Boston M. & S. J.*, 1915, *173*, 18–20.
18. CUFF, A. A case of congenital syphilis with curious bone lesions. *Quart. J. Med.*, 1895, *4*, 144.
19. DENNIE, C. C. Syphilis. Harper & Brothers, New York, 1928.
20. DIDAY, C-J, P-E. Treatise on Syphilis in New-Born Children and Infants at the Breast. Trans. by Whitley; notes by Sturgis. Wm. Wood, New York, 1883.
21. DITTRICH, E. W. Two cases of syphilis hereditaria tarda. *Post Graduate, N. Y.*, 1909, *24*, 356–359.
22. DUNHAM, E. C. Gummatous osteoperiostitis of the skull in congenital syphilis. *Am. J. Dis. Child.*, 1925, *30*, 690–699.
23. FEULARD, H. Syphilis héréditaire. *Ann. de dermat. et syph.*, 1895, *6*, 219.
24. FITZWILLIAMS, D. C. L. Syphilitic affections of bones met with in childhood. *Brit. J. Child. Dis.*, 1912, *9*, 97–111.
25. FOURNIER, A. Quoted by Stokes and others.
26. FRAENKEL, A. Ein Fall von Lues hereditaria, mit besonderer Betheiligung der Knochen und der Leber. *Verhandl. d. Cong. f. innere Med.*, 1897, *15*, 497–500.
27. GAUCHER. Les ostéopathies de la syphilis héréditaire tertiaire. *Rev. gén. de clin. et de thérap.*, 1911, *25*, 627–629.
28. GAUCHER. Les ostéites suppurées et les osteoarthrites de l'hérédo-syphilis tertiaire. *Ann. d. mal. vén.*, 1906, *1*, 3–21.
29. GAUCHER and GIROUX. Hérédo-syphilis tertiaire avec ulcération de la jambe gauche. *Bull. Soc. franc. de dermat. et syph.*, 1908, *19*, 336.
30. HERXHEIMER, G. Ueber die pathologische Anatomie der kongenitalen Lues. *Med. Klin.*, 1907, *3*, 1561–1564.

30a. HILL, BERKELEY. See Ref. 8.

31. HOCHSINGER, C. Studien über die hereditäre Syphilis. Leipzig u. Wien, 1898; 1904.
32. HUTCHINSON, J. On cases of inherited syphilis in adults with exceptional features. *Polyclinic, Lond*, 1900, *2*, 287–295.
33. IRONSIDE. Von Recklinghausen's disease and congenital syphilis. *Brit. J. Vener. Dis.*, 1926, *3*, 267.
34. JONES, R., and LOVETT, R. W. Orthopedic Surgery. Wm. Wood and Co., New York, 1923, pp. 293 and 294.
35. KARSNER, H. F. Presentation of a pathological specimen. *Proc. Path. Soc. Phila.*, 1910, *13*, 64.
36. KIENBÖCK. *Wien med. Wchnschr.*, 1926, *76*, 1035.
37. LANCEREAUX, E. Quoted by Barton and Hill.
38. LANE, J. E. Symmetrical synovitis of the knee in congenital syphilis (Clutton's joints). *Am. J. Syphilis*, 1922, *6*, 611–615.
39. LANE, J. E. Syphilitic bursitis (luetic bursopathy of Verneuil). *J. Am. M. Ass.*, 1924, *82*, 852–854.
40. LAROCHE, G., and BARTHES. Un cas pléonostéose chez un hérédo-syphilitique. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1927, *51*, 459–464.
41. LÉVY-BING, A., and DUROEUX, L. Un cas d'hyperostoses syphilitiques héréditaires des os longs. *Ann. d. mal. vén.*, 1913, *8*, 116–124.
42. LÉVY-FRANCKEL, A. Ostéo-périostite suppurée de l'hérédo-syphilis tertiaire. *Ann. d. mal. vén.*, 1906, *1*, 122.
43. LINDSEY, J. W., RICE, E. C., and SELINGER, M. A. Bone changes in congenital syphilis. *Am. J. Syph.*, 1927, *11*, 118–126.
44. MACCALLUM, W. G. Text Book of Pathology. Saunders, Philadelphia, 1928, pp. 741–744.
45. MANN, H. C. Some notes on hereditary syphilis. *Guy's Hosp. Gaz.*, 1912, *26*, 144–147.
46. MENARD, V. LE MOINE, F., and PÉNARD, I. Contribution à l'étude clinique et radiographique de la syphilis héréditaire des os longs. *Gaz. d. hôp. Par.*, 1908, *81*, 567–574.

47. Menninger, Karl A. Heredosyphilitic cranial osteoporosis. *Radiology*, 1925, *4*, 480–491.
48. Menninger, W. C. Congenital syphilis and gigantism. *Endocrinology*, 1926, *10*, 405–412.
49. Meurisse, P. Sur un cas d'hérédo-syphilis tardive. *Ann. d. mal. vén.*, 1927, *22*, 820–822.
50. Morgan, J. H. A discussion on congenital syphilitic manifestations in bones and joints. *Brit. M. J.*, 1895, *2*, 697.
51. Mouchet and Meaux-Saint-Marc. Sur les formes anormales de l'hérédo-syphilis tardive des os longues. *Bull. et mém. Soc. de chir. de Par.*, 1913, *39*, 1347–1358.
52. Nobécourt, P., Pichon, E., and Prétet, H. Congenital syphilis of the bones and liver in a boy of twelve years. *Arch. de méd. d. enf.*, 1927, *30*, 164–171.
53. Parrot, J. Sur une pseudo-paralysie causée par une alteration due systeme osseux, chez les nouveau-resalteints de syphilis héréditaire. *Arch. de physiol. norm. et path.*, 1871–1872, *4*, 314–333.
54. Parrot, J. *Soc. anat.*, 1873; *Mem. arch. physiol.*, 1876.
55. Parkinson, J. P. Late effects of inherited syphilis. *Brit. J. Child. Dis.*, 1908, *5*, 87–90.
56. Pendergrass, E. P., and Bromer, R. S. Congenital bone syphilis. Am. J. Roentgenol. & Rad. Therapy, 1929, *22*, 1–21.
57. Pinard, M. Hérédosyphilis "dite" tardive. *Bull. Soc. franç. de dermat. et de syph.*, 1921, *28*, 279–281.
58. Pommer and Looser. Quoted by Stoloff.
59. Post, A. A case of late congenital syphilis. *Med. & Surg. Rep. City Hosp.*, 1898, *9*, 233.
60. Ranvier, L. Syphilis congenitale. *Compt. rend. Soc. de biol.*, 1865, *1*, 39.
61. Roederer, M. J. Ostéomyélite hérédo-syphilitique. *Presse méd.*, 1923, *31*, 727.
62. Rosen, N. R. Quoted by Péhu, M., and Enselme, J. Sur la syphilis congénitale des os longs dans la première enfance. *Rev. franç. de pediat.*, 1925, *1*, 261–269. Also quoted by Hochsinger.
63. Rosenstein, R. Quoted by Taylor, R. W. Syphilitic Lesions of the Osseous System in Infants and Young Children. Wm. Wood & Co., New York, 1875.
64. Rouillard, J., and Calmels, J. Hérédo-syphilis tardive. *Bull. et mém. Soc. méd. d. hôp. de Par.*, 1926, *50*, 900–905.
65. Saunders, A. A case of syphilitic periostitis. *West Lond. M. J.*, 1910, *15*, 43.
66. Scott, C. R. Bone lesions of congenital syphilis. *Am. J. Dis. Child.*, 1924, *28*, 38–50.
67. Sequeira, J. H. A clinical lecture on some late manifestations of inherited syphilis. *Lancet*, 1914, *1*, 11–13.
68. Spackman, E. D. Observations of ten cases of delayed congenital syphilis. *Lancet*, 1922, *2*, 65–66.
69. Spence, R. C., and Tittle, L. C. A case of congenital syphilis with ascites. *South. M. J.*, 1923, *16*, 512–513.
70. Stadler, E. Ueber Knochenerkrankung bei Lues hereditaria tarda. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1907, *11*, 82–85.
71. Steinmetz. Un cas rare de syphilis héréditaire osseuse. *Presse méd.*, 1923, *31*, 727.
72. Stokes, J. H. Modern Clinical Syphilology. Saunders, Philadelphia, 1926.
73. Stoloff, E. G. Bone cavities. Am. J. Roentgenol. & Rad. Therapy, 1927, *18*, 26–42.
74. Sutherland, G. F., and Mitchell, J. H. Effects of treatment on bone lesions in congenital syphilis. *J. Am. M. Ass.*, 1923, *81*, 1752–1757.
75. Sutherland, G. F. Some late manifestations of hereditary syphilis. *Internat. Clin.*, 1895, *4*, 235.
76. Trimble, W. B. Tardy hereditary lues (two cases). *J. Cutan. Dis. inc. Syph.*, 1912, *30*, 349.
77. Tscherniawaki, W. A. Ueber einen Fall von Osteochondritis und Dactylitis luetica hereditaria. *Ztschr. f. orthop. Chir.*, 1906, *16*, 306–321.
78. Tubby, A. H. The bone and joint lesions in hereditary syphilis. *Brit. J. Child. Dis.*, 1908, *5*, 49–52.
79. Turnbull, Herbert M. Recognition of congenital syphilitic inflammation of the long bones. Article written by Eardley Holland in Reports and Public Health and Medical Subjects No. 7; Ministry of Health, H. M. Stationery Office, 1922; Also *Lancet*, 1922, *1*, 1239–1241.
80. Valleix. *Bull. Soc. anat. de Par.*, 1834, *9*, 169. Quoted by Taylor, see Ref. 63.
81. Villemin. L'ostéite syphilis héréditaire. *Rev. gen. de clin. et de thérap.*, *1908*, *22*, 97–99.
82. Virchow. Quoted by Wegner.
83. Von Gies. Quoted by Barrie.
84. Waldeyer and Kobner. Beitrage zur Kentniss der hereditäre Knochen Syphilis. *Virchow's Arch. f. path. Anat.* (*etc.*), 1872, *55*, 367.
85. Ware, M. W. X-ray studies of the bones in congenital syphilis. *Tr. VIth Internat. Derm. Congress, N. Y.*, 1907, *2*, 801.
86. Weber, F. P. A note on congenital syphilitic osteitis deformans. *Brit. J. Child. Dis.*, 1908, *5*, 83–86.
87. Wegner, G. Ueber hereditäre Knochensyphilis bei jungen Kindern. *Virchow's Arch. f. path. Anat.* (*etc.*), 1870, *50*, 305–322.
88. Yampolsky, J. Charcot's joint associated with congenital syphilis. *J. Med. Ass. Georgia*, 1923, *12*, 457–461.

ROENTGENOLOGICALLY DEMONSTRABLE CHANGES IN BONE IN GAUCHER'S DISEASE

REPORT OF A CASE

By B. R. KIRKLIN, M.D., *and* HANS W. HEFKE, M.D.
Section on Roentgenology, The Mayo Clinic, Fellow in Radiology, The Mayo Foundation
ROCHESTER, MINNESOTA

GAUCHER'S disease belongs to the diseases that are accompanied by more or less marked splenomegaly. The differential diagnosis of Banti's disease, atypical leucemia, and other diseases in which spleens are enlarged, is often difficult. Since Pick, in 1922, described the so-called osseous form of Gaucher's disease, many such patients have been examined for lesions of the bone which might be demonstrated roentgenologically. Fischer, in 1928, reviewed from the literature 15 reports of cases of lesions of the bone in Gaucher's disease and added 2 of his own. We are reviewing 12 other cases from the literature (vonMueller, Santee and Lindau) and are reporting one case from The Mayo Clinic.

Gaucher's disease is considered by most writers on the subject to be a disease of disturbed lipoid metabolism rather than of neoplastic origin. Kerasin, a lipoid substance, can be demonstrated in Gaucher's cells. These cells belong to the reticuloendothelial system and become large and clear when kerasin has been deposited in them. The spleen, liver, lymph nodes and the medulla of the bones have been shown to contain these cells. Their invasion of the bone marrow leads to decalcification of the bone and localized areas of destruction which, if large enough, may be demonstrated by the roentgen ray. Junghagen stated that one may expect changes as follows: (1) marked general osteoporosis; (2) porous and trabeculated spongiosa; (3) destruction of the spongiosa either in small or large areas; (4) thinning of the cortex and widening of the long bones, particularly the lower end of the femur, and (5) compression of diseased bones, particularly the head of the femur, by the weight of the body.

In the 17 cases reviewed by Fischer, there were changes in the head of the femur in 7 cases, in the vertebrae in 6, in the lower part of the femur in 6, in the tibia in 3, and in the humerus in one case. Fischer believes that widening of the lower end of the femur, producing what he terms a bottle shape, is one of the first changes and occurs before any areas of destruction can be demonstrated in the skeleton.

In the cases reviewed by us the bones were involved as follows: vertebrae in 2 cases; head of femur and pelvis in 6; lower part of the femur in 5; tibia in 3; humerus in one case, and skull in one. In vonMueller's case there was a definite destructive lesion in the hip joint and in the head of the femur, similar to that caused by tuberculosis. The same picture was found in Santee's case, and again the appearance of tuberculosis of the hip was mentioned. Lindau's case, apparently in a rather advanced stage of the disease, showed many roentgenologic signs of involvement of bone, including decalcification of the long bones with areas of destruction of varying size and compression of the vertebrae. Lindau also emphasized the resemblance of the lesions to lesions of tuberculosis. In 4 cases of Gaucher's disease, Mühsam noted only one case in which there was widening of the lower end of the femur. In one of the 2 cases described by Milch and Pomeranz, there was absorption in the skull and long bones, areas of destruction in the humerus, involvement of the hips and head of the femur, and widening of the lower ends of the femurs; in the other case only medullary absorption and widening of one tibia were pres-

ent. Walt, Rosenthal and Oppenheimer found demonstrable lesions of bone in roentgenograms in 6 of 8 cases. They found the most common early change to be fusiform expansion of the lower third of the femur. In their opinion, gross skeletal changes, such as bending and pathologic fracture, are rare; only one example in the 8 cases was noted. In one case a pathologic fracture of the spine, and in 3 cases pathologic fracture of long bones had occurred; the entire skeleton except the skull showed rarefaction. In 2 cases the femurs and tibias were involved, and in one of them the pelvis and fibula also. In 3 cases the head of the femur was mushroom-shape and the neck was shortened. Bilateral fusiform expansion of the lower third of the femur was noted in 4 of the 6 cases; in 2 of them it was the only demonstrable roentgen sign and was considered to be an early indication of the disease, as Fischer had previously asserted.

CASE REPORT

Our patient, a Jewess, aged twenty-six, was examined at The Mayo Clinic in September, 1927. As a child she had been sickly. At the age of seven years her spleen had been found to be enlarged. General treatment improved her health somewhat. In 1921, her spleen had been irradiated. She had felt fairly well until 1927, when she noticed definite enlargement of the spleen and increased weakness.

The spleen was found to be very large, reaching the symphysis pubis; the liver was palpable 10 cm. below the costal margin. There were some areas of pigmentation in the face, and fat pads on the nasal margin of the juncture of the cornea and sclera. The hemoglobin was 58 per cent; erythrocytes numbered 3,570,000, and the leucocytes 5,200; the color index was 0.8. The percentage of leucocytes was: lymphocytes 20, large mononuclears 2.0, transitionals 0.5, neutrophils 76.5, and eosinophils 1. The coagulation time was eleven minutes and thirty seconds, and twelve minutes and thirty seconds, respectively, on two occasions. Roentgen examination of the skeleton was not made.

It was decided to give irradiation before operation. Following this, the general condition of the patient improved, and in November, 1927, splenectomy was performed. The spleen was large, firm, pinkish and adherent posteri-

Fig. 1. Changes in bone in Gaucher's disease.

Fig. 2. Changes in bone in Gaucher's disease.

orly; the liver was also enlarged, and contained tiny shot-like nodules. The report after microscopic examination was "Gaucher's spleen with marked endothelial proliferation, and

FIG. 3. Changes in bone in Gaucher's disease.

Gaucher's liver with an accumulation of pigment in the cells similar to that found in the spleen." The patient recovered uneventfully from the operation and her health improved considerably afterward. When she visited the Clinic in July, 1929, she had gained 10 pounds. Six months before the visit she had suffered from rather severe pain in the right thigh and leg, which was relieved by heat. Examination did not disclose a mass in the abdomen. Roentgen examination disclosed enlargement of the medulla and thinning of the cortex in the humerus and radius of both arms and of the upper ends of both femurs. The thorax, spine, pelvis and skull appeared to be normal. This case apparently does not belong to the osseous type of Gaucher's disease according to Pick's description. The symptoms referable to the bones appeared late in the course of the disease, the lesions demonstrable by the roentgen ray were not severe nor destructive, and there were no pathologic fractures. The vertebrae apparently were not affected. Only the long bones showed more or less uniform roentgenologic signs. The most marked change was the general decrease in density, which in many respects might be compared with senile osteoporosis (Fig. 1). The cortex was markedly thinned but did not present any areas of destruction (Fig. 2). The trabeculae of the medulla were not as fine as normally, but rather coarse (Fig. 3). It appeared as if they had been spread apart by a process taking place between them, rather than that they had been destroyed by malignant cells. The changes were seen in the humerus and radius of both arms and in the femurs. The changes were most marked in the shafts of the femurs. The lower ends were somewhat widened (Fischer's sign), as shown in Figure 4.

Considered from a standpoint of differential diagnosis the picture was rather typical of the changes in bone in Gaucher's disease. There was no definite, well circumscribed area of destruction of bone suggestive of metastasis or multiple myeloma. It would be more difficult, however, to distinguish it from marked senile atrophy if the patient were old. Contrary to the ex-

FIG. 4. Changes in bone in Gaucher's disease.

perience of many observers, the roentgenologic picture of the long bones in this case can hardly be attributed to tuberculosis or syphilis.

REFERENCES

1. Fischer, A. W. Das Röntgenbild der Knochen, besonders des Femur in der Diagnose des Morbus Gaucher. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1928, *37*, 159–164.
2. Junghagen, Sven. Röntgenologische Skelettveränderungen bei Morbus Gaucher. *Acta radiol.*, 1926, *5*, 506–516.
3. Lindau, Arvid. A case of Gaucher's disease. *Acta path. et microbiol. Scandin.*, 1928, *5*, (*Suppl.*), 22–23.
4. Milch, Henry, and Pomeranz, Maurice. Bone changes in Gaucher's splenomegaly. *Ann. Surg.*, 1929, *89*, 552–560.
5. von Mueller, Friedrich. Problems of disease of the joints. *Arch. Int. Med.*, 1927, *40*, 399–419.
6. Mühsam, Richard. Die operative Behandlung des Morbus Gaucher. *Arch. f. klin. Chir.*, 1928, *153*, 215–234.
7. Pick, L. Zur pathologischen Anatomie des Morbus Gaucher. *Med. Klin.*, 1922, *18*, 1423–1424.
8. Santee, H. E. Gaucher's disease. *Ann. Surg.*, 1927, *86*, 707–714.
9. Walt, Sara, Rosenthal, Nathan, and Oppenheimer, B. S. Gaucher's splenomegaly with special reference to skeletal changes. *J. Am. M. Ass.*, 1929, *92*, 637–644.

SARCOMA OF THE RIB*

By ROBERT J. REEVES, M.D., *and* H. H. KASABACH, M.D.
NEW YORK CITY

PRIMARY tumors occurring in the ribs and chest wall are chiefly sarcomata and carcinomata. The diagnosis is usually not made until the appearance of a tumor mass. Persistent pain over a long period is one of the chief symptoms. It is as a rule dull, boring in character, and is not affected by respiration.[2,8] The question of trauma has been emphasized by some writers,[6] but in a number of the cases reported there is no history of injury.

Webber,[8] in 1900, seems to be the first to report a case in which the diagnosis of spindle cell sarcoma was made. Lund,[4] in 1913, presented a thorough review of the literature and analysis of cases reported. His discussion, however, is limited chiefly to the surgical aspect. Molimard,[5] in 1908, found 39 cases in the literature. The most common site of occurrence of the tumor was in the sixth, seventh, and eighth ribs posteriorly, and usually involving more than one rib. The first rib was involved in only 3 cases, the second in 6 cases. The tumor mass, in the majority of cases, expanded outside the chest, and only when it pushed inward did it impinge upon the intercostal nerves and produce pain. Extension of the tumor was found in the parietal, but not in the visceral, pleura.

The roentgen appearance of the tumor in the rib varies from a purely destructive process to a combination of destruction with bone production radiating outward from the rib. The soft tissue tumor can usually be seen extending about the involved ribs.

CASE 1 (Unit No. 76096). A white girl, aged eighteen, was admitted Medical Service of the Presbyterian Hospital, Nov. 8, 1928, complaining of pain in the left chest. The latter part of August, two and one-half months previously, after a long swim, she began to have a dull, constant pain in the lower left side of the chest, aggravated by deep inspiration. Three weeks prior to her admission the diagnosis of pleurisy was made, and she was put to bed. A week later the family physician discovered the presence of fluid in the chest, and presumed she had a tuberculous pleurisy with effusion.

On admission her temperature was 99°F., pulse 84. A film of the chest on Nov. 10, disclosed a dense shadow over the lower half of the left lung field with displacement of the heart which was interpreted as fluid. On Nov. 14, 500 c.c. of blood-tinged fluid was removed. Two more thoracenteses were performed during

FIG. 1. Case 1. Destruction of the outer portion of the ninth rib with considerable bone production radiating outward from it. The soft tissue tumor mass extends upward to the sixth rib.

* From the Department of Medicine, Columbia University, and the Roentgen-Ray Department of the Presbyterian Hospital, New York City.

the month of December, at which time 700 and 1000 c.c. of blood-tinged fluid was removed. Guinea pig inoculations failed to disclose tuberculosis.

On Dec. 24, a roentgen examination of the chest wall (Fig. 1) disclosed a destructive and productive process in the left ninth rib at the posterior axillary line, and extending backward for a distance of 5 cm. Small areas of diminished density were scattered throughout the involved area, with irregular, curved, streaky shadows of calcium density in the soft tissues about it. This was interpreted as osteogenic sarcoma.

On Jan. 7, 1929, a rib resection was performed by Dr. Hugh Auchincloss, which disclosed an inoperable tumor involving the ninth rib, and involving the chest wall and pleura. Portions of the eighth, ninth and tenth ribs were removed with part of the mass.

The pathological report was as follows: "Sections taken from the tumor show masses of cells which tend toward radial arrangement around the blood vessels. The cells are large and polyhedral, with fairly uniformly staining chromatin, and very little cytoplasm. Mitotic figures occur, two to three to every high power field. There are other areas in which strands of more hyperchromatic cells are found extending between connective tissue bun[illegible] The marrow spaces of the bones contain large numbers of round cells, but these do not resemble the cells of the tumor. There is no bone production seen." The diagnosis was sarcoma —probably Ewing type.

Roentgen therapy was begun on Jan. 16, 1929. During the following eight months she was given fractional doses of high voltage roentgen rays, applied front and back, over the lower portion of the left chest, with intervals of short rest, totalling about eight erythema doses. Roentgenograms of the chest April 10, showed a striking diminution in the shadow at the left base. A shadow was now noted at the left apex projecting inward from the medial wall, suggesting an extension of the tumor. Re-examinations May 24 and July 25 showed a continued increase in the size of the shadow at the left apex and the development of a new mass projecting from the mediastinum lower down. The latter part of July she began to have fever, gradual loss of weight, and pain in the left shoulder. There was a definite tanning and scaling of the skin over the area irradiated. Slight ptosis of the left upper eyelid was noticed. The left upper part of the chest was irradiated with some

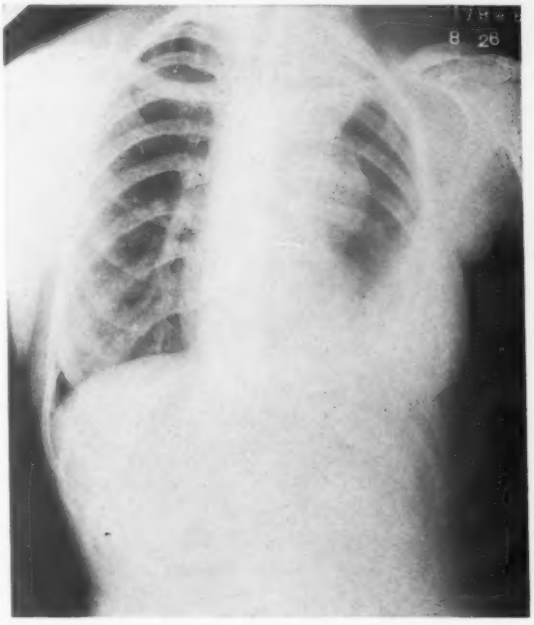

Fig. 2. Case 1. Recurrence of the tumor mass about the rib and extension along the mediastinal pleura to the apex of the lung.

regression of the tumor shadow. In the meantime the shadow at the left base began to grow again (Fig. 2).

On Oct. 23, she was given a series of six injections of Coley's toxin, with no appreciable benefit. Pain in the chest became more severe, and the temperature remained high. The last roentgen examination, Nov. 7, showed most of the left lung to be covered by the shadow of the tumor. She became steadily worse and on Nov. 9 died.

Necropsy disclosed a diffuse extension of the malignant process into the pleura, left lung, diaphragm, pericardium and mediastinum. Metastases were found in the right lung and caudate lobe of the liver. The calvarium was not opened.

Case II (Unit No. 84777). A white boy, aged nineteen, came to the Vanderbilt Clinic, July 18, 1929, complaining of a severe "cold", of four months' duration, and of sharp pain in the right chest. The pain was more severe on deep inspiration, and was more troublesome when

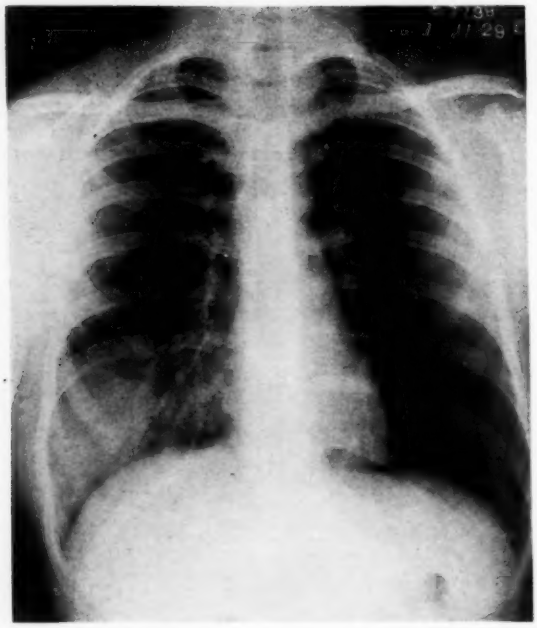

FIG. 3. Case II. Destruction of the posterior portion of the right tenth rib with very little bone production. A rounded tumor mass projecting into the lung or pleural cavity.

lying down. Six weeks prior to admission he noticed a lump below the right scapula, and a constant feeling of numbness over a small area in the right upper quadrant, with occasional dull aching pain about the right infrascapular region. There was no history of injury.

Physical examination disclosed a firm, nodular mass measuring 13×8 cm. and 3 cm. in thickness, arising from the region of the ninth, tenth and eleventh ribs near the posterior axillary line on the right side. To the right of the umbilicus was an area of partial anesthesia. The chest was negative except for an area of dullness in the region of the mass. The abdominal reflexes on the right were decidedly less active. Otherwise the physical examination was negative. Roentgen examination of the chest on July 11 (Fig. 3) disclosed a moderately dense, rounded shadow in the right lung field, just above the diaphragm, projecting forward from the posterior wall over the tenth rib. The posterior half of this rib appeared partially destroyed, and there was no evidence of new bone production. The diagnosis was sarcoma of the tenth rib.

On July 18, aspiration of the mass produced nothing but a small amount of bloody fluid. The intracutaneous tuberculin test was negative. The clinical diagnosis was either tuberculosis or sarcoma, with most of the evidence favoring the latter.

On July 20, a small incision was made over the center of the mass and a portion of it removed.

Microscopic examination showed connective tissue and striated muscle invaded by a tumor composed of small polyhedral cells with large, irregular nuclei. The cells varied as to morphology and size, and had no definite arrangement. Mitotic figures averaged one in every two high power fields. The diagnosis was "sarcoma of the rib."

The growth appeared to be inoperable, and it was decided that a radical excision of the involved rib was not indicated. He was referred to the roentgen therapy department for treatment. Between July 25 and Oct. 13, 1929, he received fractional doses of short wave roentgen rays approximating a total of two erythema doses. Roentgen examination of the chest on Sept. 13 (Fig. 4) showed the mass to have practically disappeared. Although there was no change in the appearance of the tenth rib, the pain was relieved, and he gained weight.

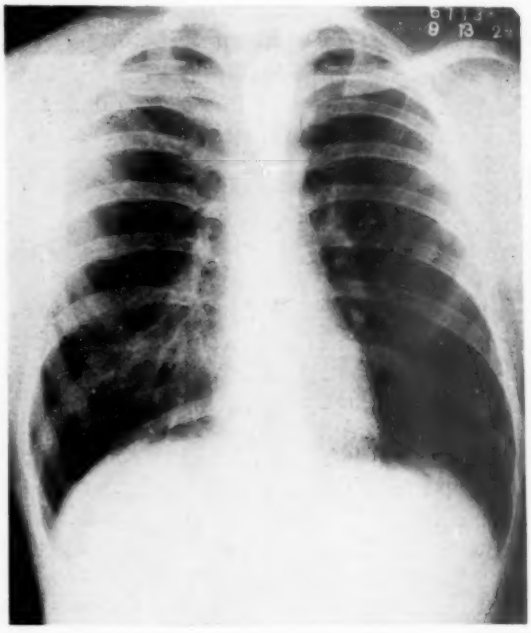

FIG. 4. Case II. Disappearance of the soft tissue tumor after the administration of fractional high voltage therapy.

On Oct. 20, he was re-admitted to the hospital, complaining of chilly sensations of seven weeks' duration, and pain in the right chest. The palpable tumor mass reappeared about the size of an orange. The surrounding soft tissues were tender but not discolored. His temperature was 103°F., and the pulse rapid. Roentgen examination of the chest on Nov. 26 (Fig. 5) showed no evidence of a tumor mass within the chest, and no evidence of repair of the involved portion of the tenth rib. Roentgen therapy was not considered advisable at this time, but a series of injections of Coley's serum was begun daily, or every other day, until Dec. 2. During this treatment he had severe reactions, the temperature rising as high as 104°F. at times. The mass showed no change in size. On Nov. 21, roentgen therapy was begun, and during the following three weeks he received one and one-half erythema doses over the tumor with no apparent effect. Roentgen examination of the chest on Dec. 24 (Fig. 6) showed most of the right side to be covered with a homogeneous dense shadow, suggesting recurrence of the tumor.

Fig. 5. Case 11. No evidence of bone regeneration about the tumor.

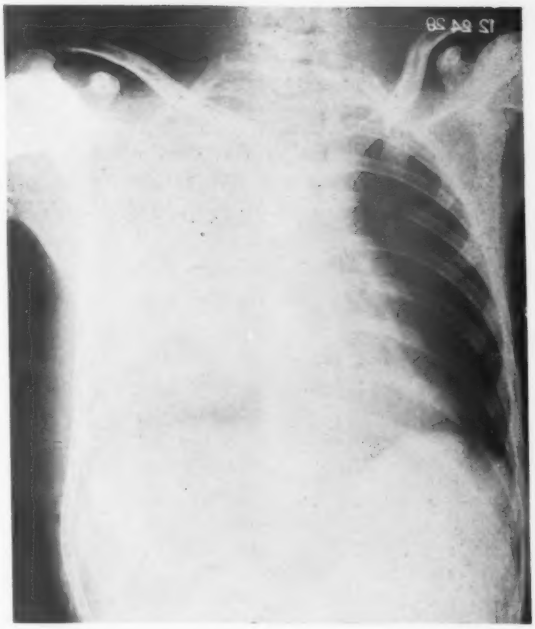

Fig. 6. Case 11. Rapid recurrence of the soft tissue tumor during treatment with Coley's serum and a small amount of radiotherapy.

His condition grew rapidly worse, and the tumor mass continued to grow steadily. He was sent to a convalescent home where he died on Feb. 13, 1929.

CONCLUSION

Sarcoma of the rib is to be differentiated from tuberculosis, which can be done only with great difficulty because the tumor may be only a destructive process resembling tuberculosis. In young individuals the history of injury, associated with pain should suggest a tumor. Palliative roentgen therapy should be used in all cases as a means of relieving pain and prolonging life.

REFERENCES

1. Deruginsky, S. Resection of portion of the chest wall and of the diaphragm for primary sarcoma of the pleura. *Ann. Surg.*, 1906, *43*, 645–651.
2. Gatewood. Sarcoma of the rib. *S. Clin. N. Am.*, 1922, *2*, 811–819.
3. Hedblom, C. A. Sarcoma of the fourth rib (right); excision by three-stage operation; x-ray treatment. *S. Clin. N. Am.*, 1926, *6*, 865–871.

4. LUND, F. B. Sarcoma of the chest wall. *Ann. Surg.*, 1913, *58*, 206–217.
5. MOLIMARD, E. Traitement des tumeurs du sequelette thoracique. Lyons, 1908, 40 pp.
6. OUTLAND, J. H., and CLENDENNING, L. Sarcomatous proliferation (sarcoma of rib), in a traumatic tumor sixteen years after its first appearance. *J. Am. M. Ass.*, 1915, *65*, 1177.
7. REYES, C. Anterior thoractomy for chondrosarcoma of the rib. *J. Philippine Islands M. Ass.*, 1925, *5*, 268–269.
8. WEBBER, H. W. A case of sarcoma of the sixth rib in the removal of which the pericardial and left pleural cavities were opened; recovery. *Lancet*, 1900, *2*, 1347–1348.

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MENSTRUAL HEADACHES*

By CHARLES L. MARTIN, M.D.
Associate Professor of Radiology, Baylor College of Medicine
DALLAS, TEXAS

IN STUDYING the histories of our gynecological cases sent in for radiation therapy, we have found that severe recurrent headache associated with menstruation has appeared many times as one of the major symptoms bringing the patient to a physician. The seriousness of this condition is well illustrated by the following quotation from "Queries and Minor Notes"[30] in a recent issue of the *Journal of the American Medical Association:*

To the Editor:—Can you give me any suggestions concerning the relief of recurrent vomiting and headache during menses? I have a patient, aged 40, regular, with no anatomic basis for trouble, who has had violent "bilious" attacks with every period for 20 years. She is a nullipara, otherwise in excellent health, is not neurotic, and does not magnify her ills. Would any of the desiccated endocrine preparations be indicated? I have tried various migraine remedies, diets, and other usual measures with no relief.

Answer: It is unfortunate that there is no specific remedy for the vomiting and headaches that occur at the time of the menses. Endocrine preparations are nearly always ineffectual. Occasionally, they give temporary relief, but the result may usually be attributed to the effect on the psyche. Attention to the general health and especially the bowels helps some women.

Such a gloomy outlook should intrigue the interest of the various medical specialties, radiology along with the rest.

It is customary to deal first with etiology in discussing a disease, but since we are dealing here with a symptom-complex rather than a disease, the detection of a specific cause offers many difficulties. The perusal of a limited number of case histories suggests the conclusion that a certain group of menstrual headaches results from organic disease, or perhaps from an overtaxed nervous system; while others coming later in life are due to an approaching menopause. However, one combination of symptoms has occurred frequently enough to indicate the possibility of a specific underlying causative factor. The sufferer begins to have headaches at puberty, the attack usually beginning just before or on the first day of menstruation and lasting one or two days. The pain is in the occipital or frontal region, sometimes appearing behind the eyes or in the temples and is often accompanied by nausea and vomiting of an intractable character. The patient is usually confined to bed for a few days each month, and tries all sorts of headache remedies, often resorting to opiates before real relief is obtained. Sinuses are drained, teeth removed, nasal septums straightened, appendices removed, uterine suspensions performed, and other measures too numerous to mention resorted to, with little or no success. There is in most cases a complete absence of headaches during pregnancy, with a reappearance of the syndrome as soon as the periods are re-established. Between the ages of thirty and forty the attacks become more severe, and one or more headaches of lesser severity appear between the menstrual periods. The patient spends about half of her time in bed and may lose weight because of the repeated attacks of vomiting. However, these attacks often end suddenly with an instantaneous return of a good appetite, so that any temporary weight loss is quickly compensated for. As the menopause is passed, the headaches may disappear or be markedly improved, although in some instances they show no change.

Many explanations of this syndrome have been advanced Some suggest that

* Read at the Thirtieth Annual Meeting, American Roentgen Ray Society, New York City, Sept. 17–20, 1929.

the condition is a true migraine, although this helps matters very little, since the nature of migraine is so poorly understood. It is true that migrainous attacks recur at regular intervals. Allan[13] showed that they appeared once a month or oftener in 82 per cent of 566 cases. They are variously attributed to disturbances in lipoid metabolism, hepatic dysfunction, diets too rich in sugar or protein, anaphylactic reactions, plugging of a foramen of Monro, etc. Needless to say, these explanations hardly seem to explain menstrual headaches. Their definite relation to menstruation, pregnancy, and the menopause, indicates some connection with the endocrine system. Abbott[1] claims that they have an ovarian origin and states that his cases improved after the administration of corpus luteum. Abel[2] recommends a migraine serum made by Bohnstedt from the placenta. In the light of our present knowledge, it seems probable that this substance contains a large amount of ovarian hormone, which explains the good results produced. More recently Fishbaugh has published the histories of 13 patients afflicted with menstrual headaches, all of whom obtained relief from ovarian therapy. He admits, however, that some cases do not respond to this type of treatment and cites two examples. Sufficient evidence is at hand, therefore, to indicate that ovarian function plays a rôle in the causation of the headaches under consideration.

It is well known that the endocrine glands are dependent one upon another, but the exact nature of the interrelationship is poorly understood. A close connection between the sexual apparatus and the pituitary gland undoubtedly exists. Blumgarten[5] describes a syndrome quite similar to the one outlined above. It is his opinion that the demand on the pituitary is excessive during menstruation and the attempt of the gland to enlarge sufficiently to meet the overload produces the headaches. He claims real success from the administration of pituitary extract. Pardee[28] has encountered a clinical picture characterized by frontal headaches often at the time of the menses, somnolence, mental dullness, polyuria, increased sugar tolerance or glycosuria, oculomotor palsies, hemianopsia, abnormal bony growth and hair distribution, adiposity, and sexual regression, which he attributes entirely to pituitary dysfunction and cures through administration of the whole gland. Timme,[37] who has made an intensive study of headaches of hypophyseal origin, divides those due to an enlarged gland not of a neoplastic nature into three classes: (1) those having had previous operative or other critical disturbances of the gonads; (2) those in whom a status thymicolymphaticus preceded the pituitary symptoms, and (3) those having a long-standing thyroid insufficiency. The cases under consideration do not fall exactly into any of these classifications, but the pituitary cannot be ruled out as an active agent in the mechanism that produces menstrual headaches.

Ehrenfest[11] states that Aschheim and Zondek have shown that the urine of pregnant women contains very large amounts of both ovarian and pituitary hormones and smaller quantities are found in the other body fluids. It may be, therefore, that the active functioning of these glands is responsible for the absence of headaches during pregnancy and the success obtained by the administration of gland extracts in certain cases may depend upon the proper re-balancing of the hormones within the body. Assuming that both the ovary and the hypophysis are at fault, Tierney[36] has succeeded in relieving a patient with menstrual headaches by the administration of corpus luteum and extract of the anterior lobe of the pituitary simultaneously, although he chooses to call the condition migraine.

Several explanations of the mechanism of menstrual headaches have been offered but none of them are entirely satisfactory. Hartung,[16] in discussing a similar condition

which he calls migraine, claims that the pain is caused by an enlargement of the pituitary within its rigid container, the sella turcica. Tierney states that J. Herbert Fisher of the Royal London Ophthalmic Hospital, who suffers from migraine himself, accepts this theory. Sargent[33] goes a step farther and claims that an enlargement of the pituitary produces an elevation of blood pressure which in turn produces the pain. It must be remembered, however, that the hypophysis enlarges during pregnancy and also at times during the menopause, and yet menstrual headaches are usually absent during these periods. The frequent association of nausea and vomiting suggests the possibility of an increased intracranial pressure at the time of the attack, but the writer has been unable to find accurate reports of the appearance of the eye grounds or of changes in blood pressure at the time of onset of the headache.

Be the mechanism of the pain production what it may, the causation of the syndrome seems to be definitely tied up with the activity of the pituitary and the ovaries. Intelligent therapy should hinge upon the regulation of their function. The output of their products can be augmented by the administration of gland extracts and this method of treatment has already been referred to. However, we have available a powerful force in the form of radiation which, in view of its peculiar action on gland structures, should be a most valuable aid in attacking this problem. As regards the sexual apparatus, it is only necessary to mention the well-known paralyzing effects of large doses of radiation on the gonads, and the fact that many workers have been able to re-establish a normal flow in cases of functional amenorrhea, by subjecting the ovaries to small doses of roentgen rays. Drips and Ford[10] produced decided improvements in a group of cases of primary oligomenorrhea, amenorrhea, menorrhagia, and metrorrhagia, by administering small doses of roentgen rays to the ovaries and hypophysis on the supposition that the underlying cause in each instance was an ovarian hypoactivity. Del Buono[8] produced similar results by applying small doses to the pituitary region alone. Werner[40] used a similar technique, except that he also applied small doses to the thyroid in refractory cases. It is his contention that this method has a beneficial effect on dysmenorrhea, amenorrhea, menopause symptoms, and pregnancy toxicoses, especially hyperemesis and hypersalivation. Mild irradiation of the pituitary and thyroid as an efficient method of treating menopause symptoms such as hot flashes, sweating, coldness and tingling of the extremities, etc., has been advocated by Borak,[6] Heimann,[17] Porchovnik,[29] Kaplan,[19] and others. Szenes and Palugyay[34] have analyzed the symptoms in a series of cases treated in this way and it is interesting to note that 14 out of 28 patients complaining of headache obtained more or less relief, while 2 women developed headaches that they had not previously complained of. The proper use of radiation in endocrinology is perhaps not well understood, but its potency in influencing the glands of internal secretion can no longer be doubted.

Since many patients obtain relief from their menstrual headaches after the menopause, the artificial production of the change demands consideration. Fishbaugh[14] describes 2 cases that obtained relief in this way. One had a menopause produced by irradiation, and a complete hysterectomy was done for the other. Caesar,[7] who believes that migraine in women has an ovarian origin, recommends roentgen castration as the logical method of treatment. It may be of interest to report of few of our cases that have responded to this form of therapy:

Case 1. A married woman, aged forty-two, came to the hospital in August, 1923, complaining of a "pinching sensation" in the lower abdomen for about ten days following each

period, extreme nervousness, and recurrent headaches.

Her menses began at the age of eleven and she developed a severe dysmenorrhea. At eighteen she was thrown from a wagon and was badly jolted up, although no organic injury was discovered. From that time on an occipital headache preceded each menstrual period and lasted two to four days. She had no nausea or vomiting with the attacks. The pain extended from the back of the neck to the top of the head and was of a throbbing character. She had no visual disturbances.

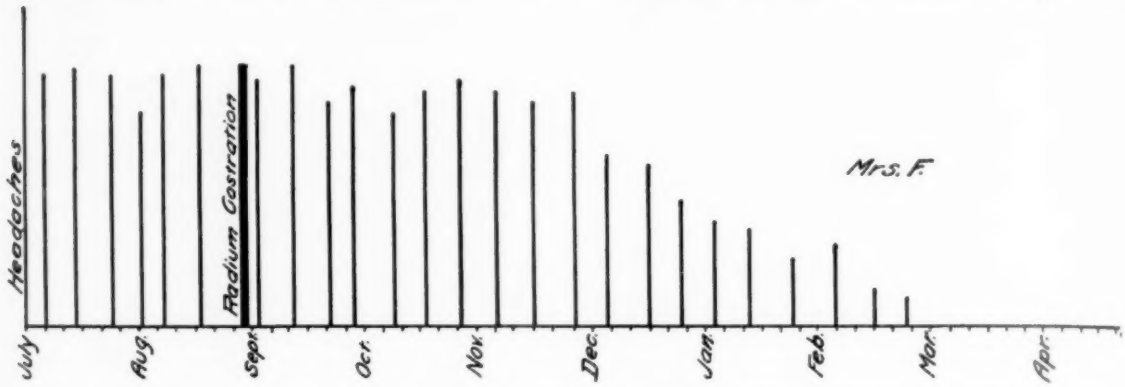

FIG. 1. Chart illustrating the gradual cessation of menstrual headaches after radium castration in Case 1. The severity of each attack is represented by the height of each vertical line. These lines are spaced in accordance with the time of appearance of the headaches. This patient has remained well for four and a half years.

At sixteen she weighed 135 lbs. and thought she was in good health. At twenty when she married, her health was not good and she weighed 110 lbs. She steadily became weaker, developed a leucorrhea and complained of pain low in the back and in the lower left abdomen. At that time her hands and feet were often numb and she had frequent fainting spells. At twenty-four, when she became pregnant, her weight was 97 lbs. During pregnancy she gained considerable weight and thinks her headaches cleared up, although she is not sure. Delivery was uneventful and she retained the weight she had gained.

For some two or three years before admission, the headaches had appeared three or four times a month, but a severe attack always accompanied menstruation. During this same period, a severe pinching sensation appeared in the lower portion of the abdomen after each period. This condition was temporarily relieved on two occasions by a curettage. Following each headache, she felt very dull and her memory began to fail, so that she often stopped speaking in the middle of a sentence because of an inability to remember what she had started to say. She became very nervous and was much depressed mentally most of the time.

Examination revealed a well-developed woman weighing 160 lbs. The uterus was normal in size, shape, and position. There was some tenderness in the vaults, particularly on the left side, but no definite masses could be made out. The sella turcica measured 12 × 10 cm.

One 50 mg. radium capsule having a filtration of 1 mm. of brass and 1 mm. of rubber was placed in the fundus of the uterus for nineteen hours, and the pelvis was cross-fired with roentgen rays through five portals of entry, each area receiving 30 ma-min., with a target skin distance of 10 in., a filter of 3 mm. of aluminum and a kilovoltage of 120.

For a month thereafter, she had a slight bloody discharge and felt nervous and let down. The discharge then ceased permanently, but her headaches continued as severe as ever for about two months. They then began to decrease in severity, and during the next three months she steadily improved in every way. At the end of the six-month period the nervousness, depression, and spells of forgetfulness had practically disappeared, and she had only an occasional headache of slight severity. Hot flashes appeared two months after the administration of radiation and continued for about one and one-half years, but they were never

troublesome. For the past four and one-half years she has enjoyed excellent health and states that she feels as well mentally and physically as she did at the age of sixteen.

the return of the periods. For several years, the pain in her head had appeared once or twice between periods. She was very nervous and had occasional hot flashes.

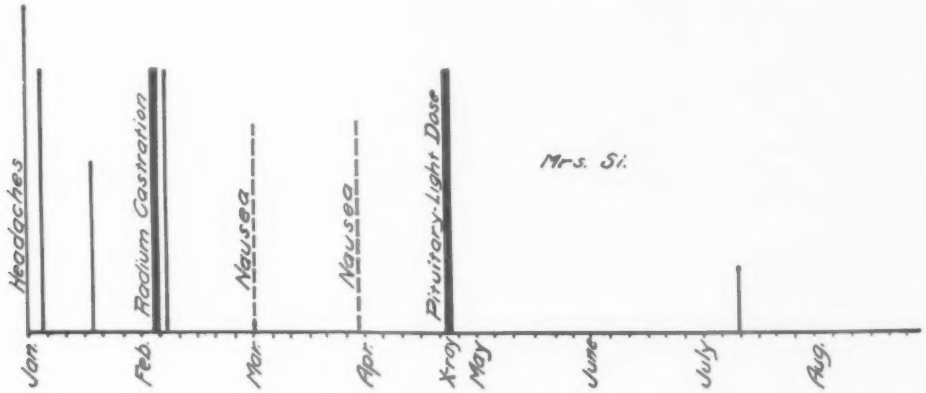

Fig. 2. Almost immediate cessation of menstrual headaches after radium castration in Case II. Menopause symptoms were relieved by light doses of roentgen rays administered to the pituitary.

Although this patient obtained an excellent end-result, her headaches continued for six months after she was treated and she was very uncomfortable during the first half of this period. The results in the next case offer a marked contrast in that only one headache appeared after the castration dose was given.

Case II. A married woman, aged fifty-two, came to the hospital because of menstrual irregularity and menorrhagia of two years' duration. The periods were quite profuse, sometimes lasting for weeks at a time. For a year she had had hot flashes and had complained of increasing nervousness.

At puberty she began to have severe headaches with each menstrual period, beginning in the back of the neck and extending to the top of the head. These attacks lasted from one to three days and were accompanied by nausea and vomiting of such severity that she was usually confined to bed. During the height of the attack, there were spots and flashes of light before her eyes. She thinks the ingestion of sugar, worry and excitement, made the attacks much worse. Nothing that she could do produced relief, but she was most comfortable when receiving large doses of aspirin while she remained absolutely at rest in a dark room.

During pregnancy the headaches entirely disappeared only to return as bad as ever with

The patient was a very large pale woman. The uterus was slightly enlarged and normal in shape and position. The vaults were negative. A curettage obtained a considerable amount of endometrium which showed a simple hyperplasia on histological examination.

Fifty mg. of radium in one capsule, filtered with 1 mm. of brass and 1 mm. of aluminum, was placed in the fundus of the uterus for twenty-four hours and 270 ma-min. was applied to the lower abdomen anteriorly using 200 kv. and a filter of 0.75 mm. of copper and 1 mm. of aluminum at a target skin distance of 50 cm.

The menses ceased immediately after the treatment was given, but the hot flashes and nervousness became much worse. At the time of each period she had rather severe nausea and vomiting, but the headaches did not reappear.

About three months after the pelvic irradiation was given, 60 ma-min. was directed at the pituitary through each temple, using portals 4 in. square with a kilovoltage of 200, a filter of 0.75 mm. of copper and 1 mm. of aluminum, and a target skin distance of 50 cm. The attacks of nausea and vomiting ceased at once and the hot flashes became so infrequent as to be almost negligible. There has been only an occasional headache of slight severity since the castration dose was given. She has shown no change in weight for several years.

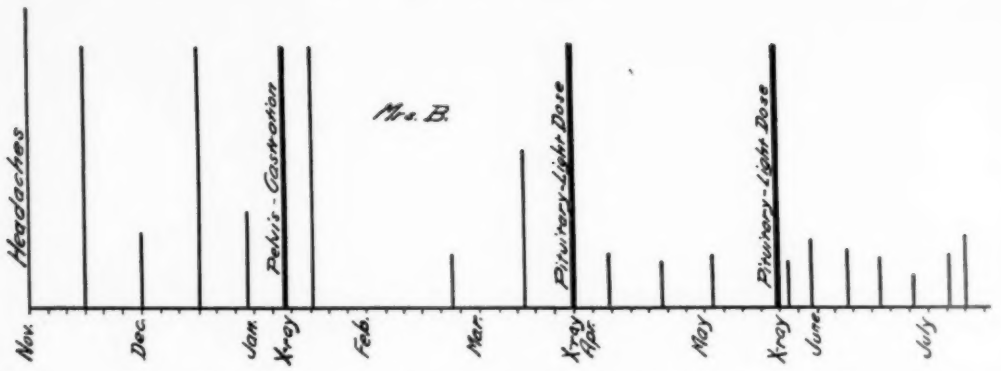

FIG. 3. Menstrual headaches partially relieved by roentgen castration in Case III. The patient still has frequent light attacks, not relieved by roentgen rays administered to the pituitary.

She feels that her general condition is now better than it has been for years.

Unfortunately, it is not always possible to obtain such clean-cut results. The following case is one in which only partial success was obtained, although the patient insists that she is much better.

CASE III. A married woman, aged forty-two, consulted us because of menstrual headaches and menorrhagia.

Her menses began at the age of twelve. Each period was ushered in by a severe headache, accompanied by nausea and vomiting. The pain usually began in the "cheek bones" and extended to the vertex and sometimes all over the head. It lasted twenty-four to forty-eight hours. Her mother and sister were afflicted in a similar manner. At thirty-four she became pregnant and the headaches disappeared entirely, only to reappear as bad as ever when the periods were re-established.

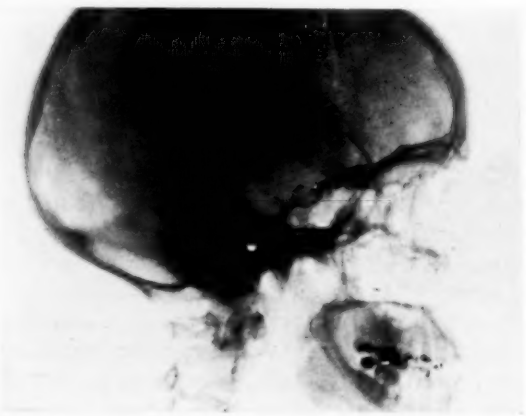

FIG. 4. A lateral view of the skull of Case III. The sella turcica is unusually small, but not otherwise abnormal.

At forty the regular attacks gradually became more severe and headaches of lesser severity began to appear between the periods. Her tonsils were removed, also the teeth, and the sinuses gone over without relief. She was given purgatives, although her bowels always moved regularly. For a time she obtained some relief from injections of pituitary extract and ovarian extract, but these remedies soon lost their effect. Coal tar products lost their potency, and for about six months prior to the radiation therapy she received three or four hypodermic injections of morphine during each attack before she was relieved of the excruciating pain in her head and the uncontrollable vomiting. She lost about 18 lbs. during this period, but although she was steadily losing ground, she maintained an unusually optimistic attitude towards her trouble. Her last period before coming to the hospital was profuse and lasted eleven days, but she had never suffered from any menstrual irregularity before.

The patient was a slender woman who showed evidence of recent weight loss. The uterus was normal in size and shape and in third degree retroversion. Films of the sinuses were negative. A lateral view of the skull showed a normally shaped sella turcica which had an unusually small size. It measured 6 × 10 cm. Two hundred and seventy ma-min. was administered to the pelvis through each of two 20 cm. ports, one in front and one behind, using 200 kv., a filter of 0.75 mm. copper and 1 mm. aluminum and a target skin dis-

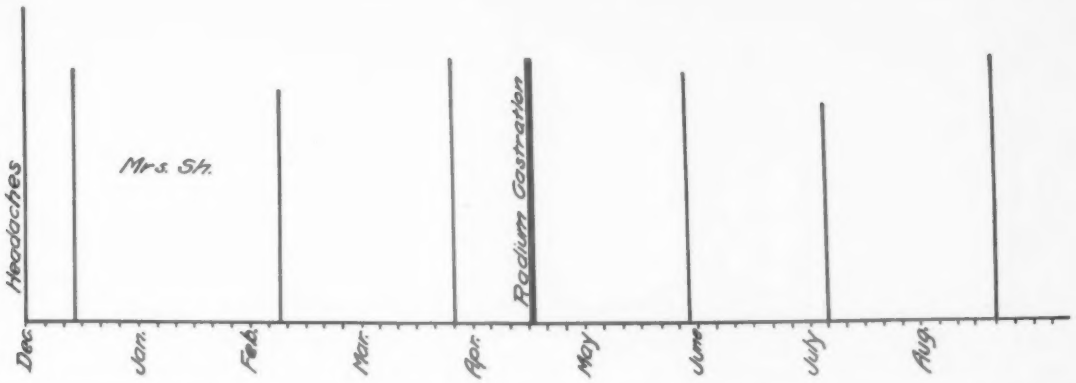

Fig. 5. Menstrual headaches not influenced by radium castration in Case iv. It seems likely that this patient has the so-called "pituitary headaches" which might be relieved by pituitary extract.

tance of 50 cm. A day elapsed between the two treatments.

Six days later, a period began with an unusually severe headache lasting four days and she menstruated seventeen days. There have been no more periods. About six weeks after she was treated, she had a mild headache and a more severe one appeared about sixteen days later. Soon after this attack, and again about six weeks later, she received 60 ma-min. directed to the pituitary through a small portal in each temple, using 200 kv., a filter of 0.75 mm. copper and 1 mm. aluminum, and a target skin distance of 50 cm. After the first dose was given to the pituitary region, the headaches appeared every eight to ten days, but were rather mild and usually lasted only a few hours. During six months of observation she has received no more hypodermics, but her physician gives her papine for some of the attacks. Although her general condition seems much improved, she has lost 10 lbs. since the castration dose was given, and is still having relatively mild headaches at frequent intervals.

The continued loss of weight and recurrent mild headaches that this patient has are puzzling. The pleasant effects produced by small doses of roentgen rays directed to the pituitary in Case ii led us to try the same method on Case iii. Light headaches began to appear at frequent intervals as soon as this therapy was started, and the rôle played by the roentgen rays in their production is an open question. It seems possible that they may eventually disappear when the endocrine balance is finally re-established. Unfortunately, castration does not always bring relief. The following case has shown no improvement of any sort during four months of observation:

Case iv. A married woman, aged fifty-two, consulted us because her physician had removed a specimen of tissue from the cervix, which was diagnosed histologically as carcinoma. Although she had no signs or symptoms of malignancy, radiation therapy was advised as a safety measure.

At puberty she began to have severe frontal headaches, first on one side and then on the other, beginning before each menstrual period and lasting one to three days. The pain was sometimes referred to the eyes and temples, but was never accompanied by nausea or vomiting. She had no visual disturbances.

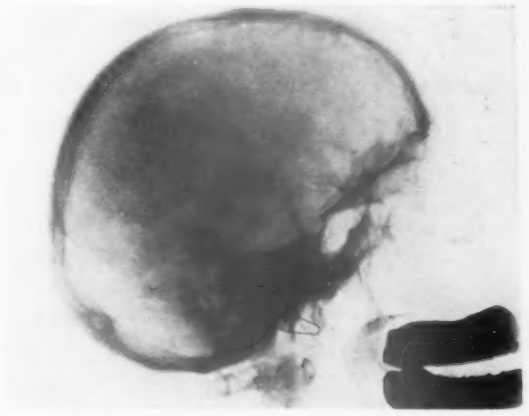

Fig. 6. A lateral view of the skull of Case iv. The sella turcica shows no abnormality except that the posterior clinoids are inclined backwards.

Excitement and worry made the attacks much worse and she obtained her greatest relief by lying quietly in a dark room.

At the age of eighteen she put on glasses, but the headaches continued to appear as before. During pregnancy the attacks occurred with their usual frequency. She has always been too fleshy. At forty-three she lost 83 lbs. on a diet of raw vegetables and buttermilk, and thinks her headaches were less severe at that time. However, the weight was soon regained after the diet was discontinued.

At forty-four her tonsils and turbinates were removed and her glasses were changed, but no improvement followed these procedures, and she thinks she has been worse ever since.

About two years before admission, her periods became irregular, often being spaced six weeks to three months apart. During this period she had two or three headaches between her periods, but a severe attack always accompanied menstruation.

The patient was a very large pale woman who weighed 253 lbs. No abnormalities could be made out in the pelvis except that the cervix showed evidence of a recent cauterization. Three 25 mg. radium capsules filtered with 1 mm. of brass and 1 mm. of aluminum were placed in tandem, so as to extend from the external os to the fundus, and were left in place for twenty-four hours; 240 ma-min. was then administered to the pelvis anteriorly through a port 20 cm. square, with 200 kv., a filter of 0.75 mm. copper, and 1 mm. aluminum and a target skin distance of 50 cm. During four months of observation, she has had no more periods, but her headaches have continued about as they did before she was treated. She is again on a strict diet and has managed to lose 32 lbs. since leaving the hospital, but she is still much too fat. A lateral view of the skull made recently shows no definite abnormality in the size or shape of the sella turcica, which measures 14×13 cm. Her general condition does not show any definite improvement.

This patient's tendency to gain weight and the continuation of her headaches during pregnancy suggest that her condition may be somewhat different from that of the preceding cases. Her attacks are more like the so-called "pituitary headaches" and she has been advised to try a course of pituitary extract, if improvement does not appear within two months.

Having established the value of radiation castration as a treatment for menstrual headaches, the question immediately arises as to what is to be done with the young woman who suffers from this malady. Most radiologists agree that it is very undesirable to produce a menopause in a woman less than forty years of age. Timme[37] even states that "pituitary headaches" may be brought on by critical disturbance of the gonads. The following case illustrates one of the possible outcomes of such treatment.

CASE V. An unmarried woman, aged forty-three, consulted us because of severe headaches. During her menstrual life, she had headaches accompanied by nausea and vomiting with

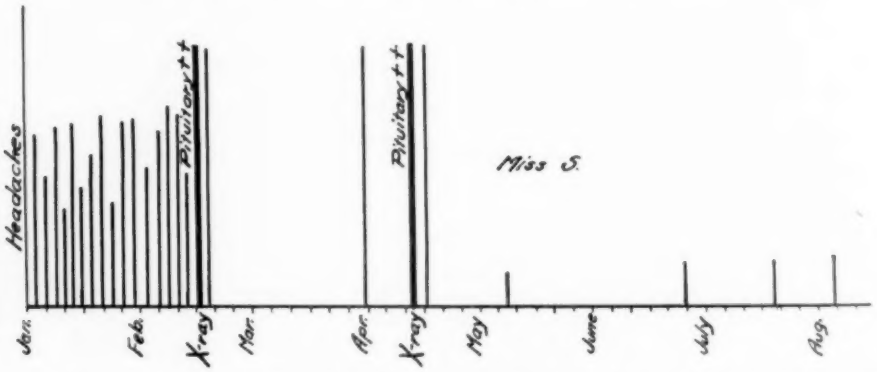

FIG. 7. Chart for Case V, who was relieved of menstrual headaches by a subtotal hysterectomy, but a few years later developed attacks in such a severe form that she was rarely free of headache. Two series of deep roentgen treatments applied to a much enlarged pituitary relieved her of most of her symptoms.

each period. These attacks usually lasted twelve to twenty-four hours. When she was thirty-two years old a hysterectomy was done for a uterine fibroid. She thinks the ovaries were not removed. The headaches ceased and she began to gain weight. When she was thirty-seven, she weighed 148 lbs., having gained a total of 27 lbs.

At the age of forty she again developed severe headaches accompanied by nausea and vomiting. The pain always appeared in the left frontal region, starting behind the left eye and continued for about twenty-four hours. At first the attacks were about a week apart, but they gradually became more frequent until they were almost continuous. The pain was throbbing in character, much like that experienced with a "cavity in a tooth" and was usually accompanied by some dimming of vision. She could obtain no relief except from narcotics and at admission was sick almost all of the time.

The patient was a well-developed woman, weighing about 140 lbs. A gastrointestinal examination revealed no abnormality except some unexplained tenderness in the lower abdomen. A lateral view of the skull showed a definite enlargement of the sella turcica, which measured 17×18 cm. The posterior horns appeared to be somewhat eroded. An ophthalmologist reported that the visual fields were not abnormal.

Deep roentgen rays were directed to the pituitary through the temples, 270 ma-min. being given through a 4 inch port to each temple on two successive days, using 200 kv., a filter of 0.75 mm. copper and 1 mm. aluminum and a target skin distance of 50 cm.

Fig. 8. Lateral view of the skull of Case v. Note the marked enlargement of the sella turcica.

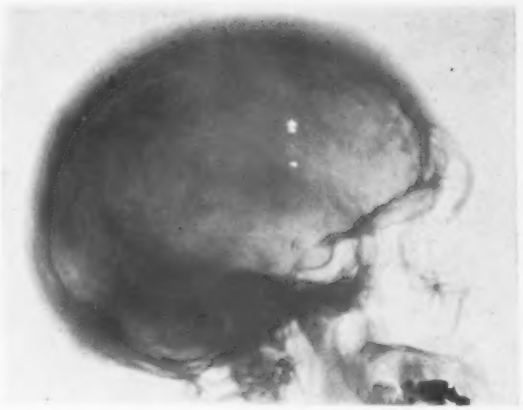

Fig. 9. Skull of a patient with acromegaly. The sella turcica is not quite so large as the one shown for Case v.

She had a very severe headache with nausea and vomiting immediately after she was treated, but was then entirely free of symptoms for six weeks, at the end of which time she had another severe attack.

When she recovered from this headache, the roentgen treatment was repeated, and it again brought on an intense headache with nausea and vomiting, which soon cleared up. During four months of observation, she has had four very mild headaches which were relieved by aspirin and which she attributes to a pyelitis that recurs at intervals. Her general condition is much improved.

Although a hysterectomy produced relief of symptoms for a time, it seems possible that the ensuing decrease in ovarian function may have been a factor in producing hypertrophy of the hypophysis. The appearance of the sella turcica was consistent with the formation of an adenoma of the pituitary and treatment was administered on the assumption that such a tumor existed. Radiation has been recommended for this condition by Fejér,[13] Ranschburg,[31] Terrien,[35] Blumberg,[4] Enfield,[12] Roussy, et al.,[32] Wehefritz,[39] Grant,[15] Dott, Bailey and Cushing,[9] Nemenow and Jugenburg,[25] Towne,[38] Heinismann and Czerny,[18] Nordentoft,[26] Kaplan,[20] and many others. These authors report im-

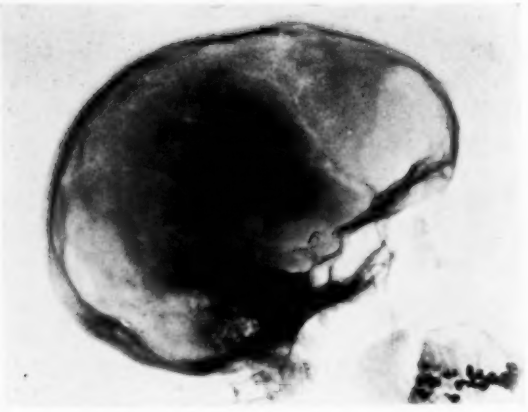

Fig. 10. Skull of Case VI. The sella turcica is large and the posterior clinoids appear to be thinned out in their lower portions. No benefit was obtained from irradiation in this case.

provement in partial blindness, diabetes insipidus, dystrophia adioposogenitalis, and acromegaly secondary to intensive irradiation of enlarged pituitary glands, and it seemed logical to apply similar treatment in the case just cited. The results justified the procedure, but it would hardly be fair to assume that a similar pelvic operation would be successful in all young women, or that a similar enlargement of the pituitary might occur which could be efficiently handled by roentgen therapy. The following case illustrates an entirely different result which followed castration:

Case VI. An unmarried woman, aged forty, consulted us because of severe headaches. Her periods began at the age of thirteen, at which time they were normal and were not accompanied by headaches. However, at twenty-five the menses became profuse and irregular and she developed right-sided frontal headaches, which preceded each period and usually lasted one day. She had no nausea or vomiting. As time went on it was necessary to use codeine to relieve the pain. At thirty-four her physician advised her to have an artificial menopause produced because of a troublesome menorrhagia. She received in another city a number of roentgen treatments over the pelvis, and after two years her periods ceased entirely. However, after they stopped, the headaches continued in a more troublesome form, appearing every three weeks at first and gradually becoming more frequent, so that at admission they were spaced about a week apart. They had been increasing steadily in severity, so that even a quarter grain of morphine did not give complete relief, and nausea and vomiting appeared with them. She thinks the ingestion of sugar, overwork, worry and excitement, made the attacks much worse. She did not have a polyuria, but often complained of black spots before her eyes, flashes of light, and dimness of vision while the pain was at its worst.

During the six months prior to admission, she received ovarian extract, pituitary extract, mineral baths, massage, cathartics, Morse wave treatments, and gall-bladder drainages, without improvement. She then had her appendix and tonsils out, and the teeth and sinuses received attention, but the headaches continued as bad as ever.

The patient was a slender, bright, alert, nervous woman. She wore glasses and her hair was prematurely gray. A lateral view of the skull showed the sella turcica slightly enlarged and the posterior horns appeared to be thinned out in their lower portions. The sella measured 12 × 15 cm.

Sixty ma-min. was directed to the pituitary through each temple, using 200 kv., a filter of 0.75 mm. copper, and 1 mm. aluminum and a target skin distance of 50 cm. After two weeks of observation, during which no improvement was noted, 180 ma-min. was directed at the pituitary through each temple, using the same factors. This treatment precipitated a very severe headache, requiring several hypodermic injections of morphine. During two months of observation, she has continued to have headaches just as she did before the treatment was given. Her weight has decreased slightly during the past year.

In this case, it seems quite apparent that the headaches became much worse after the artificial menopause was produced. Although the roentgen appearance of the sella suggested an increase in the size of the hypophysis, intensive roentgen therapy did not produce relief as it did in Case v. Although too many conclusions cannot be drawn from only one case, it would seem that one is treading on thin ice in advising

castration as a therapeutic measure for young women suffering with menstrual headaches.

Considerable evidence has been collected to show that castration produces definite changes in the hypophysis. Livingston[22] described his findings in rabbits a number of years ago and observed that in some spayed animals the pituitary increased as much as 23 per cent in weight, whereas in others no change was observed. He also noted that animals showing an increase in the size of the pituitary showed no increase in body weight, and vice versa. Many explanations of the changes in the hypophysis have been advanced. Nukariya[27] finds many signet ring shaped cells filled with colloid in the pituitary glands of castrated rats and calls them castration cells. He thinks they are formed from the normal basophiles. Maffeo[23] worked with castrated dogs and found a marked increase of connective tissue of the hypophysis. Lehmann[21] finds a different histological picture in the pituitary during pregnancy and after castration. The pregnant animals show a marked hyperemia and an increase in chief cells in the gland, whereas after castration there in an increase in the basophile cells. Mariani[24] found multiple round hyaline masses in the hypophyses of capons after castration.

Although experimental workers are not in strict agreement relative to the exact changes produced, all seem to believe that inactivation of the ovaries has a definite effect on the hypophysis. The possible relation of this effect to the relief of menstrual headaches in women nearing the menopause demands consideration. There may be a difference in the reaction of the pituitary following the cessation of gonad function in young women and women of menopause age. This difference probably accounts for the very severe menopause symptoms appearing in young women after castration, some of which can be relieved by irradiation of the hypophysis. Although the problem is a most complex one, repeated trials may finally evolve a technique whereby the various endocrine glands may be irradiated in just the proper manner to prevent recurrent menstrual headaches, without producing the menopause. Such treatment could be given patients of any age, and would be such a boon to womankind that a considerable amount of experimentation on human subjects seems entirely justifiable, even though the methods used be entirely empirical.

CONCLUSIONS

1. One type of menstrual headache, characterized by pain in the occipital or frontal regions, and nausea and vomiting, and relieved during pregnancy, probably has an endocrine origin.

2. This type of headache may be partially or completely relieved in a certain number of women past the age of forty by the production of an artificial menopause with irradiation.

3. The use of castration in younger women seems of doubtful value and may even accentuate the symptoms.

REFERENCES

1. Abbott, S. K. Periodic headaches of ovarian origin. *N. York M. J.*, 1920, *112*, 724.
2. Abel, S. The use of migraine serum "Bohnstedt" in gynecology. *Deutsche med. Wchnschr.*, 1921, *47*, 1229–1230.
3. Allan, W. Status hemicranicus and frequency of migraine attacks. *J. Nerv. & Ment. Dis.*, 1928, *68*, 591–593.
4. Blumberg. Roentgenotherapy of pituitary tumors and of gynecologic diseases of pituitary origin. *München. med. Wchnschr.*, 1922, *69*, 739–741.
5. Blumgarten, A. S. The endocrine factors in some common functional diseases. *M. Clin. N. Am.*, 1921–1922, *5*, 1022–1066. (Pituitary headaches, p. 1029.)
6. Borak, J. The treatment of climacteric symptoms by irradiation of the pituitary and thyroid glands. *Brit. J. Radiol.*, 1924, *29*, 293–296.

7. CAESAR, G. Migraine attacks, their signs, causes and nature with special consideration of the reciprocal action between migraine and sexual life. *Med. Klin.*, 1913, *9*, 49–53.
8. DEL BUONO, PIETRO. Roentgen irradiation of the hypophysis in dysfunction of the uterus and ovaries. *Radiol. med.*, 1927, *14*, 292–300.
9. DOTT, N. M., BAILEY, P., and CUSHING, H. Consideration of hypophysial adenomata. *Brit. J. Surg.*, 1925, *13*, 314–366.
10. DRIPS, DELLA G., and FORD, FRANCES A. Irradiation of the ovaries and hypophysis in disturbances of menstruation. *J. Am. M. Ass.*, 1928, *91*, 1358–1364.
11. EHRENFEST, HUGO. Ovarian and hypophyseal hormones in the urine during pregnancy. *J. Missouri M. Ass.*, 1929, *26*, 113–115.
12. ENFIELD, CHAS. D. Acromegaly following gigantism; report of case treated by roentgen rays. *Radiology*, 1924, *3*, 492–496.
13. FEJÉR, J. Treatment of tumors of the hypophysis. *Berl. klin. Wchnschr.*, 1921, *58*, 1221.
14. FISHBAUGH, ERNEST C. Headache in relationship to ovarian dysfunction. *Endocrinology*, 1927, *11*, 445–456.
15. GRANT, F. C. The results in x-ray treatment of early pituitary lesions. *Atlantic M. J.*, 1926, *29*, 430–435.
16. HARTUNG, E. F. Present day aspects of migraine. *N. York State J. M.*, 1927, *27*, 240–243.
17. HEIMANN, FRITZ. Mild irradiation. *Klin. Wchnschr.*, 1925, *4*, 1815–1818.
18. HEINISMANN, J. I., and CZERNY, L. I. Roentgen therapy of tumors of the hypophysis. *Strahlentherapie*, 1926, *24*, 331–335.
19. KAPLAN, A. L. Roentgen therapy of climacteric changes. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1928, *38*, 565–568.
20. KAPLAN, I. I. Roentgen ray therapy in pituitary tumors. *J. Am. M. Ass.*, 1925, *85*, 268–269.
21. LEHMANN, J. The structure of the hypophysis of castrated and non-castrated rats under the influence of placental substances given internally and parentally. *Virchow's Arch. f. path. Anat. (etc.)*, 1928, *268*, 346–373.
22. LIVINGSTON, A. E. The effect of castration on the weight of the pituitary body and other glands of internal secretion in the rabbit. *Am. J. Physiol.*, 1916, *40*, 153–185.
23. MAFFEO, L. Changes in laryngeal and pituitary mucous membrane in castrated dogs. *Folia med.*, 1927, *13*, 1164–1170.
24. MARIANI, G. Changes in the hypophysis in castrated capons. *Atti d. r. Accad. d. fisiocrit. in Siena*, 1928, *3*, 5.
25. NEMENOW, M., and JUGENBURG, ANNA. Radiation therapy of tumors of the hypophysis. *Strahlentherapie*, 1928, *30*, 239–276.
26. NORDENTOFT, J. Good effects of roentgen treatment in a case of tumor of the hypophysis. *J. de radiol. et d'électrol.*, 1928, *12*, 280–283.
27. NUKARIYA, S. Relations between the generative gland and the pituitary body. *Klin. Wchnschr.*, 1925, *4*, 1307–1308.
28. PARDEE, I. H. Pituitary headaches and their cure. *Arch. Int. Med.*, 1919, *23*, 174.
29. PORCHOWNIK, J. B. The treatment of climacteric symptoms by means of irradiation of the thyroid and hypophysis according to Borak. *Strahlentherapie*, 1927, *24*, 701–709.
30. Queries and Minor Notes. *J. Am. M. Ass.*, 1929, *92*, 1375.
31. RANSCHBURG, P. Two cases of hypophyseal dystrophia adiposogenitalis treated by roentgen rays. *Deutsche med. Wchnschr.*, 1921, *47*, 1291.
32. ROUSSY, G., ET AL. Roentgenotherapy in the treatment of tumors of infundibulo-hypophyseal region. *Rev. neurol.*, 1924, *31*, 297–315.
33. SARGENT, L. D. Pituitary headaches. *Pennsylvania M. J.*, 1929, *32*, 333–335.
34. SZENES, A., and PALUGYAY, J. The results of roentgen irradiation of the hypophyseal region in cases with symptoms of menopause. *Wien. klin. Wchnschr.*, 1925, *38*, 503–507.
35. TERRIEN, F. Radiotherapy of visual disorders due to tumors of the hypophysis. *Presse méd.*, 1922, *30*, 429–431.
36. TIERNEY, JOHN L. Headache. *M. Clin. N. Am.*, 1923–1924, *7*, 1515–1544.
37. TIMME, WALTER. The glandular treatment of pituitary tumors and hyperplasias. *Atlantic M. J.*, 1926, *29*, 427–430.
38. TOWNE, E. B. Cessation of diabetes insipidus on roentgen ray treatment of pituitary gland. *J. Am M. Ass.*, 1924, *83*, 2085–2087.
39. WEHEFRITZ, E. Roentgen irradiation of tumors of hypophysis. *Fortschr. a. d. Geb. d. Röntgenstrahlen*, 1923–1924, *31*, 680–691.
40. WERNER, PAUL. Roentgen ray treatment of benign gynecological diseases *Am. J. Obst. & Gynec.*, 1927, *13*, 54–60.

DISCUSSION

DR. H. J. ULLMANN, Santa Barbara, Calif. There is one thing in Dr. Martin's paper that interested me very much, the question of dosage. Dr. Martin spoke of aggravation following a large dose and the possibility of getting results in one case where the doses were spaced at a considerable distance apart.

I have been treating a number of ovarian

dysfunctions, if I may use that term, and also am now treating a diabetes insipidus, to see what can be done. I have found that in treating the pituitary, whether for ovarian dysfunction or for the hot flashes of the menopause, the optimum dose was approximately between 70 and 80 r-units delivered to the skin through one side. This is approximately what is being used at the Mayo Clinic. In one case I raised the dose to 112 r, an increase of 40 per cent, and produced a marked aggravation of symptoms. On allowing the patient to rest for a week and then repeating the smaller dose, the patient again obtained relief. I suggest that small doses be tried at shorter intervals in some of these cases that received no benefit with the large doses at long intervals.

Dr. Hunter. What does Dr. Martin think about headaches during pregnancy?

Second, what about colonic stasis?

Third, has he had any experience in treating trifacial neuralgias that occur in pregnancy by irradiation?

Dr. Martin (closing). I am afraid I cannot answer all the questions that Dr. Hunter asked. As regards the headaches of pregnancy, I will again state that the patients considered in this paper do not have headaches during pregnancy. This is the most characteristic finding in their histories.

Colonic stasis is usually mentioned as a cause of menstrual headaches. Some of the cases in my series have had all sorts of treatment for this condition including irrigations, drugs, diets, Morse wave therapy, etc., with no relief. I feel that the syndrome really has an endocrine basis rather than a gastrointestinal origin. Dr. Hunter's question about trifacial neuralgia falls entirely outside my knowledge.

I appreciate the encouraging remarks made by Dr. Ullmann and I hope that some of the others in the Society will become interested in this subject and help to work out a successful treatment for menstrual headaches.

TEN YEARS' RESULTS WITH RADIUM IN THE TREATMENT OF TOXIC GOITER*

By R. E. LOUCKS, M.D.

DETROIT, MICHIGAN

REVIEWING past experiences and analyzing results in any new field of research is interesting and occasionally discouraging; but in this case the results have been so gratifying as to be worthy of more general application in the treatment of toxic goiter.

When Abbe and Aikins reported through this and other societies their results of this new treatment, which was largely empirical at that time, it stimulated an interest in the therapy that has been found efficient and proved satisfactory by clinical and laboratory means. The surgical mortality years ago was much higher than it is today and again, many of the protracted cases when poor surgical risks did not receive any treatment.

The advancement in medical science in the treatment of disease has kept pace with that of surgical intervention. The fact that many cases of toxic goiter in surgical hands are surgical does not disprove the fact that all such cases treated with radium by competent clinicians with approved technique can get equally as good results.

This advancement was not meant to replace surgery but to be another weapon in the armament of the skillful therapist to combat a disease that has not a definite etiological entity.

Fear of surgery without any other apparent alternative in the control of disease has sounded the closing chapter with many, and has sent others to the different cults outside the pale of scientific medicine. Cases of resistant toxic goiter that require two or more operations are a type that will require more radiation, which should always be considered in stating the prognosis.

The physiological studies of the thyroid gland with the isolation of thyroxin as one of the hormones, the pathological histology, the different clinical manifestations of the disease and the laboratory estimation of metabolism in health and disease of the gland have been the factors to stabilize the evaluation of the symptoms of a hyperactive thyroid gland.

Whether there is an inherited predisposition or that the dysfunction is due to some chemical deficiency or bacterial invasion cannot be discussed at this time. A physiological activation of the thyroid gland will give an increased metabolism, yet the clinical symptoms are not classical of pathological thyrotoxicosis. A positive differentiation between a physiological or functional activity and toxic hyperthyroidism should always be made before remedial measures are instigated.

For the relief of a clear-cut toxic adenoma or an exophthalmic goiter the indication is surgery or irradiation by radium. A conglomerate therapy of a few doses of roentgen rays for a few weeks, radium in small doses every month and probably some electric modality indicates an indefinite understanding of the procedure.

The results of radium treatment seem most gratifying since not one patient has died from the treatment in over 500 cases. Twelve were operated on because of enlarged adenomas; of the 12 cases, 5 died within three days from embolism, shock or cardiac failure. Six other cases died within a month of the treatment, too soon to have received any benefit from the radiation; 3 of them were insane from the toxic condition, one being wild and hilarious and having to be restrained. These 3 cases should probably not have been treated, but after completely controlling the toxic goiter condition and incidentally the mental condition in two other mania cases, I was persuaded to give them the benefit of the

* Read at the Fourteenth Annual Meeting, American Radium Society, Portland, Oregon, July 8–9, 1929.

treatment. Six had been refused surgical intervention while one had had the thyroid arteries ligated.

As noted in former reports, no two cases react the same to the treatment; one may show an increase in weight within two months, another note lessened tremor as the first improvement. Within the past year a few cases of toxic adenoma giving a low sugar tolerance have responded very quickly after treatment. No doubt the severe gastric and intestinal cases are caused by hepatic and pancreatic dysfunction.

When the chronic toxic thyroid has had a long course and damaged the endocardium and myocardium and eventually the kidney, the outcome is precarious. The toxicity may be controlled but the damage remains. Palliation by medical treatment with digitalis will often tide over an apparent crisis. Lugol's solution, like digitalis and the bromides, has done much harm in the past by increasing the thyroid activity and causing an immediate necessity for relief which can only be obtained by surgery. Radium radiation is slow in effect and gives better results when the toxicity has reached the peak and is subsiding.

Many individuals after thyroid surgery or radiation have a functional activation following influenza or tonsillitis, months or years after all symptoms of thyrotoxicosis have been controlled. Small doses of Donovan's solution of arsenic for a few weeks will act as a specific to this form of activity, the same as it does in the physiological activity of young persons of the high school age or young prospective mothers.

The arguments in favor of radium therapy in toxic thyroid are so many and have been brought forward by me so often in the past eight years that no repetition is needed here.

Three brief case histories follow:

Case 1304. Mrs. E. B., aged thirty-two. Treated Jan. 30, 1928. Shaky and dizzy four months. Lost 25 pounds. Pulse 144. Blood pressure 160/50. Weight 111 lbs. Metabolic rate +48 per cent. Tremor +++. Large adenoma. Diagnosis: Toxic adenoma.

Two months after radium: Weight unchanged. Pulse 146. B. P. 156/56. Less tremor. Adenoma softer.

Five months after radium: Weight 117 (gain of 6 lbs.) Rate 120. B. P. 142/70. Feels much better.

Seven months after radium: Weight 123 (gain of 12 lbs.) Pulse 96. B. P. 144/72. Tremor of right hand.

Eleven months after radium: Feels very well. Nothing to suggest former condition. Pulse 90. Weight 133 (gain of 22 lbs.) B. P. 120/70.

Thirteen months after radium: Feels fine. Pulse 84. Weight 140 lbs. (gain of 29 lbs.) Neck much smaller.

Case 1328. Miss N. F., aged thirty-five. Treated April 19, 1928. Extreme nervousness, weakness and palpitation for five months; had to be carried in. Pulse 120. Weight 98 lbs. Metabolic rate +48 per cent. Had had iodine five months previously. Diagnosis: Adenoma with hyperthyroidism.

Two months after radium: Feels much better. Tremor much improved. Pulse 86. Weight 108 (gain of 10 lbs.)

Ten months after radium: Had influenza a month ago but feels very well now. Pulse 64. No tremor. Weight 113 (gain of 15 lbs.)

The relation existing between hyperthyroidism and glycosuria has long been an interesting aspect of the study of goiter. In 1912 Van Noorden described "thyroid diabetes" and showed that glycosuria could be induced in man and animals by feeding thyroid tissue and also that it was nearly impossible to produce glycosuria in thyroidectomized animals. Glycosuria occurs in about 6 per cent of all cases of hyperthyroidism; it is found more often in acute cases, especially of the exophthalmic type. However, true diabetes is rarely coexistent with hyperthyroidism.

Studies in carbohydrate metabolism by DuBois and others show that the hyperthyroid patient is able to utilize carbohydrate normally but cannot store it in the form of glycogen, hence the glycosuria. The true diabetic differs in not being able to burn sugar in the normal way.

Hyperthyroidism is obviously a serious complication in diabetes because of the increased energy requirements associated with the raised metabolism. It is important in all goiter cases showing glycosuria to differentiate between true diabetes and a functional glycosuria. The diabetic with hyperthyroidism must be given a diet with enough calories to offset the increased metabolism, with sufficient insulin to take care of the extra food. The patient with functional glycosuria must receive sufficient calories to gain weight, ignoring the glycosuria which will doubtless clear up when the activity of the thyroid is controlled. The true diabetic will have the sugar tolerance raised as the basal metabolism falls under appropriate treatment.

This phase of hyperthyroidism has been emphasized because a proper perspective is essential to an accurate prognosis and a rational schedule of therapy. In this connection, a case history has been briefed, illustrative of unusual and almost spectacular results following radium. The case had been ranked as a moderately severe diabetes with hyperthyroidism as a complication, by the diabetic service of a famous city hospital and as such had been placed on an adequate diet with an appropriate amount of insulin. The case follows:

CASE 1337. Mrs. J. H., aged sixty-one. Treated in May, 1928. Gave a history of marked glycosuria for the past year. Took 20–40 units of insulin from August to November, 1927. Swelling of ankles. Weight two years ago 135 lbs. Last of August, 1927, 105 lbs. Weight when treated 85 lbs. Had been taken to large city hospital and put on 10 units of insulin three times daily and a diet of: protein 55 gm.; fat 200 gm.; carbohydrate 90 gm. Value of this diet 2350 calories. Was advised to have thyroidectomy; refused operation. Diagnosis: diabetes with toxic adenoma as a complication. At time of treatment, the pulse rate was 96; B. P. 154/66. Metabolic rate +44 per cent.

Three months after radium: Pulse 76. B. P. 148/68. Weight 103 (gain of 18 lbs.) Urine remained sugar-free in spite of the fact that the insulin dosage had been gradually reduced in amount and no insulin had been given in the last two weeks.

Five months after radium: Pulse 64. B. P. 152/70. Weight 99 lbs. Urine showed trace of sugar; had been guilty of such dietary indiscretions as jelly, bananas, etc.

Eleven months after radium: Pulse 72. B. P. 144/75. Weight 101 lbs. Sugar-free urine. Carries on with housework, feeling very well; slight swelling of ankles after being on feet all day. Tremor gone. The adenoma has decreased in size by half.

Summary. Weight increased from 85 to 101 lbs. Pulse reduced from 96 to 66. Tremor gone. From glycosuria to sugar-free. Insulin reduced from 30 units to 0. Hyperthyroidism controlled; adenoma decreased to at least half its size. Patient now enjoys comparatively good health instead of invalidism.

This striking change in the diabetic-hyperthyroid picture adds another link to the chain of evidence establishing the validity of radium in the treatment of thyroid disease.

CONCLUSIONS

(1) Radium is highly effective in controlling hyperthyroidism, including the diffuse exophthalmic type as well as that associated with adenoma.

(2) Results with radium parallel those with surgery; the type of case that responds poorly to radiation is identical with that which requires two or more thyroid operations.

(3) Radium therapy accomplishes a marked restoration of sugar tolerance in cases associated with glycosuria, indicating a complete control of the hyperactive thyroid.

(4) The primary mortality is nil; preoperative and postoperative morbidity is eliminated; from the standpoint of the period of disability, hospital expenses and the concomitant loss of wage-earning power, radium holds a tremendous economic advantage over any other therapeutic procedure.*

* For discussion see page 297.

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THE VALUE AND PLACE OF RADIUM IN TREATMENT OF DISEASES OF THE THYROID GLAND*

By SOLOMON GINSBURG, M.D.

NEW YORK CITY

DURING the years 1922 to 1928 I have had the opportunity to study intensively some 500 patients affected with various types of goiter. Clinically, these cases were classified into the following five groups:

1. Diffuse nontoxic, or simple goiter.
2. Nodular nontoxic, or simple adenomatous goiter.
3. Nodular toxic, or toxic adenomatous goiter.
4. Diffuse toxic, or exophthalmic goiter.
5. Malignant, or cancerous goiter.

Diffuse Nontoxic, or Simple Goiter. Patients affected with this type of goiter formed, next to malignant goiter, the smallest group in our series. In its uncomplicated form, unassociated with adenomas, simple goiter was almost invariably found in juvenile patients only. None of these uncomplicated cases were subjected to radium therapy. They were all treated by general medical measures plus iodine medication extending over a period of several months to a year. The results were very gratifying. Invariably either the thyroid gland shrank in size or failed to show any further abnormal growth.

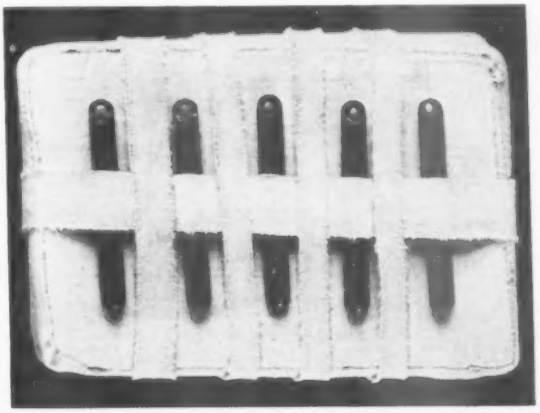

FIG. 1. Radium "block." The radium block is made of balsa wood. Its dimensions are 7 by 5 by 3 cm. It is covered by adhesive plaster. Several layers of gauze are interposed between it and the skin to serve as a cushion and to absorb perspiration. The distribution of the radium capsules is shown above. Each brass capsule, of 1 mm. wall thickness, contains 10 to 25 mg. of radium in standard steel needles, according to indications. The block is strapped in place by means of adhesive plaster and reinforced with a bandage.

FIG. 2. Radium "collar." The radium collar is made of five blocks of balsa wood, each block measuring 5 by 3 by 3 cm. The blocks are held together by adhesive plaster. Their proper adjustment to the neck is obtained by pledgets of gauze. The distribution of the radium capsules is shown above. Each brass capsule, of 1 mm. wall thickness, contains 10 to 25 mg. of radium element in standard steel needles, according to indications. The collar is strapped in place by adhesive plaster and reinforced by a bandage.

In the remaining four groups of cases radium therapy was carried out by means of the following two applicators: (1) the radium "block" (Fig. 1); (2) the radium "collar" (Fig. 2).

The radium "block" is made of balsa wood. Its dimensions are 7 by 5 by 3 cm. It is covered by adhesive plaster. Several layers of gauze are interposed between it

* From the Radium Clinic of Beth Israel Hospital, New York City. Read at the Fourteenth Annual Meeting, American Radium Society, Portland, Oregon, July 8-9, 1929.

and the skin to serve as a cushion and to absorb perspiration. The distribution of the radium capsules is shown. Each brass capsule, of 1 mm. wall thickness, contains 10 to 25 mg. of radium in standard steel needles, according to indications. The "block" is strapped in place by means of adhesive plaster and reinforced with a bandage; 3000 mg-hr. constitutes an erythema dose.

The radium "collar" is made of five blocks of balsa wood, each block measuring 5 by 3 by 3 cm. The blocks are held together by adhesive plaster. Their proper adjustment to the neck is obtained by pledgets of gauze. The distribution of the radium capsules is shown above. Each brass capsule, of 1 mm. wall thickness, contains 10 to 25 mg. of radium element in standard steel needles, according to indications. The "collar" is strapped in place by adhesive plaster and reinforced by a bandage; 6000 mg-hr. constitutes an erythema dose.

RADIUM TECHNIQUE

In the early part of our work we made use of the "block" only. The radium "collar" was a later development. During the first two years of our treatment of toxic goiter we applied the block not only over the lateral lobes of the thyroid but also over the thymus region. When we discovered that a single erythema dose of radium by means of the collar was followed by epilation some 5 to 6 cm. above and below the immediate area of application, we gave up the use of the additional thymus field and confined the treatment to the thyroid region only. The method of treatment consisted in administering one full erythema dose either in one continuous application or in fractionated doses at definitely spaced intervals, usually once every five to seven days. As our experience grew we found that the fractionated dose method in the toxic cases yielded much more satisfactory results than the single massive dose. The spacing of the intervals of treatment and the amount of the fractionated dose given was entirely gauged by the clinical severity of the case. The more severe the toxic manifestations, the smaller was the initial dose given and the longer the interval of radium application. Generally one-sixth to one-quarter of the erythema dose was given at intervals of five to seven days until a full erythema dose was reached. After each full erythema dose, or course of treatments, an interval of four weeks was allowed. At the end of this time, in addition to a complete clinical restudy a basal metabolic test was done. Guided by the findings the repetition of the dose or course of treatments was planned. On the average a moderately severe case of exophthalmic goiter or toxic adenoma of the thyroid required two erythema doses or courses. Occasionally, however, three or four courses were necessary to effect a complete clinical cure. The cases of juvenile adenoma, as a rule, required less treatment than the toxic cases.

Nodular Nontoxic, or Simple Adenomatous Goiter. This group constitued the largest number in our series. The great majority of these patients were above the age of twenty. Very few in this group were given radium therapy. Although some of these treated cases yielded encouraging results, we are not yet prepared to discuss the value and limitation of radium in the treatment of simple adenomas in adults. There were, however, a number of cases of distinctly nodular goiter observed not only in adolescents but also in children below the age of puberty. It is to this juvenile group that we wish to devote our attention in the present communication. The series of cases studied is rather small. Altogether some 20 patients were treated with radium. They deserve, however, the earnest attention of every student of the goiter problem because of immense future possibilities. For, contrary to the usual teachings in the current medical literature, concurred in by a number of prominent radiologists that not all types of nontoxic nodular goiter are amenable to radium and roentgen therapy,

radium therapy in these juvenile patients yielded highly gratifying results.

ILLUSTRATIVE CASES

Case I. A. T., female, aged eleven, was admitted to the Radium Clinic of Beth Israel Hospital in April, 1925, with a history of progressive swelling of the neck since the age of nine. On examination a diffuse and nodular enlargement of the thyroid gland was found. Toxic symptoms were absent. For a period of five months she was kept on iodine medication. At the end of that time the circumference of the neck shrank from 31 to 30 cm., but the nodular mass in the center of the neck became more prominent as the rest of the thyroid gland yielded to the iodine medication Failing to note any recession of the mass after several months of observation, 2300 mg-hr. of radium with the block at 3 cm. distance was given over the center of the nodular area. This treatment was promptly followed by the disappearance of the mass and shrinkage of the neck to 29 cm.

Case II. A girl of thirteen was admitted to the Radium Clinic of Beth Israel Hospital in September, 1925, complaining of progressive increase in the size of the neck for the past several months. Examination revealed a diffuse and nodular enlargement of the thyroid gland with predominant involvement of the right lobe. The circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 35.5 cm.

Course under iodine treatment. For a period of four months, until February, 1926, she was given moderate doses of compound solution of iodine. Two months later, in April, 1926, the circumference of her neck still measured 35 cm. The nodular or adenomatous mass in the right lobe of the thyroid gland showed no evidence of shrinkage.

Course under radium therapy. Between July 14 and 24, 1926, she was given with the radium block at 3 cm. distance 3000 mg-hr. to the right lobe and a similar dose to the left lobe of the thyroid gland. Gradual and progressive shrinkage of the gland was noted two weeks after the radium treatments were completed. In January, 1927, her general condition was excellent. She had gained 11 pounds in weight while her neck shrank from 35 to 31.5 cm. When last examined in December, 1927, the improvement persisted unchanged.

Case III. L. W., female, aged thirteen, admitted to the Radium Clinic of Beth Israel Hosptial in January, 1928, complaining of swelling of the neck and a choking sensation in the throat for the past two years. For a year prior to admission to the clinic she had been fed small doses of iodine by her family physician, with no effect upon the enlargement in the right side of the neck and only slight shrinkage of the left side. Examination revealed both a diffuse and nodular enlargement of the thyroid gland. The circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 31.5 cm.

Diagnosis: Nontoxic nodular, or simple adenomatous goiter.

Course under radium treatment. In February, 1928, she was given over the thyroid region one continuous application of 5165 mg-hr. of radium with the collar at 3 cm. distance. The result was gradual shrinkage of the thyroid adenoma. Ten months later, in December, 1928, the circumference of her neck was reduced from 31.5 to 29 cm., with decided improvement in facial appearance.

Case IV. (Fig. 3.) F. R., female, aged fourteen, first came to the Radium Clinic in August, 1927, complaining of progressive enlargement of the neck for the past two years and restlessness, nervousness, slight dyspnea and palpitation on exertion for the past two months. Examination revealed a well-nourished and developed young girl with a greatly enlarged and nodular thyroid gland and a basal metabolic rate of plus 12 per cent. Tachycardia, ocular phenomena and tremor were absent.

Diagnosis. Simple adenomatous goiter with beginning toxic symptoms.

Course under iodine medication. For a period of four months she was given moderate doses of compound solution of iodine. This treatment resulted in slow gradual shrinkage of the neck from 38 to 35 cm.

Course under radium treatment. In February, 1928, when we noted that no further shrinkage of the neck was taking place under iodine medication, we decided to resort to the use of radium therapy. This was carried out with the radium collar at 4 cm. distance. During a period of four months thirteen

Fig. 3. Case iv. Adenomatous goiter with mild toxic symptoms in a girl aged fourteen. Before radium treatment.

Fig. 4. Case iv. After radium treatment.

fractionated doses of radium were given, totaling 10,750 mg-hr. The result was exceedingly gratifying. The circumference of the neck shrank from the original 38 to 32 cm. The result persisting to date is shown in Figure 4.

Comment. We consider the above observations demonstrating the beneficial effects of radium therapy in juvenile nontoxic adenomatous goiter of the utmost significance in the management of diseases of the thyroid gland. Nodular nontoxic, or simple adenomatous goiter, as stressed by Aschoff[1] in his recent study of the goiter problem, occurs not only in adults but also in children at birth and proceeds in its biological development in early infancy. Clinically, it becomes detectable in different individuals at different ages. It is this group of nodular nontoxic goiter that yields the bulk of patients that eventually become a serious medical problem either as a result of local disfigurement, compressive phenomena, toxic manifestations or malignancy. It is the knowledge of these facts reëmphasized during the course of recent years that has induced a number of prominent surgeons to urge early removal of these simple adenomas as a prophylactic measure against toxic adenoma and cancer of the thyroid gland. That such recommendations are bound to meet with scant success every experienced physician will have to admit. For how many patients with small symptomless adenomas will readily submit to the surgeon's knife? How many parents will be readily induced to permit their children to be operated on for a comparatively small and unobtruding nodule in the neck? Very few, I dare say. Hence, we consider the observation that moderate doses of radium will favorably affect a simple adenomatous goiter in the juvenile as of the utmost significance in the management of diseases of the thyroid gland. From the standpoint of prophylaxis as well as cure, I am confident that the profession will gain a more ready ear from the public when efficient radium therapy rather than

surgery is urged as the method of choice in the treatment of thyroid adenomas in the juvenile.

Diffuse Toxic, or Exophthalmic Goiter. The value and place of radium therapy in exophthalmic goiter based upon a review of the literature and my own observations was dealt with in two previous studies.[3,5] Summarized the conclusions were:

Clinical cure of a lasting kind in exophthalmic goiter has been obtained not only by implanting radium interstitially into the thyroid gland but equally well by external applications of properly screened radium. Individualization which is the keynote of life and efficient medical therapy must be strictly observed in the treatment of Graves' disease. The exact dose of radium required to obtain a clinical cure in a case of Graves' disease varies with the individual patient. One to four courses, or erythema doses, may be required. While clinical improvement may be noted within a few weeks after commencement of radium treatment, many months may elapse before the patient is restored to health. To obtain the best results a combination of radium therapy plus rest in bed, proper diet and medication is highly desirable. The great potency of radium as a therapeutic agent in Graves' disease was demonstrated by the numerous case reports from the literature and our own cases which had to be treated in an ambulatory manner and in which no special drug therapy was employed. In spite of its great potency radium therapy properly employed is a safe and convenient agent. In a period of three years of active treatment of cases of Graves' disease by radium not a single one of our patients showed any skin burn, telangiectasis or adhesions to the neighboring structures.

Further observations have corroborated the above statements and are amply illustrated by the following case reports:

Case v. Miss D. H., aged twenty-seven, was admitted to the Radium Clinic of Beth Israel Hospital in August, 1924, complaining of the following symptoms: hoarseness, insomnia, fatigability, nervousness, irritability, palpitation and tachycardia, weakness, goiter, exophthalmos, poor appetite, diarrhea, urticarial eruptions and loss in weight. Duration of symptoms four years. Examination revealed a patient with all the classic signs of Graves' disease. Pulse 140 per minute. Basal metabolism plus 63 per cent. The thyroid gland showed a diffuse and irregular enlargement with predominant involvement of the isthmus. The circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 38 cm. For nearly four years she had been actively treated medically without any results. Finally, as a last resort, thyroidectomy was urged.

Course under radium treatment. When this patient first came under my personal observation in January, 1925, she had been getting small doses of radium to the thyroid with very slight improvement either in local or general symptoms. We therefore decided to administer larger doses. Between March 27 and May 1, 1925, she was given 5640 mg-hr. of radium in divided doses with the radium block at 3 cm. distance, to the thyroid and thymus regions. The result was prompt improvement in all her symptoms and a decrease in the circumference of the neck from 38 to 34.5 cm. During June and July, 1925, the course of treatments was repeated. This was followed by further improvement in symptoms and a decrease in the size of the neck to 33 cm. Within the next few months she felt perfectly well and was able to resume her professional duties. Reëxamination in the early part of 1929 found her to be in excellent health.

Case vi. A woman, aged thirty-five, with classic symptoms of Graves' disease, unilateral exophthalmos, barely palpable thyroid gland and basal metabolism of plus 48 per cent was admitted to the Radium Clinic in March, 1925. Duration of symptoms six months.

Course under radium treatment. During April and May, 1925, the patient was given with the block at 3 cm. distance 6000 mg-hr. of radium to the thyroid and thymus regions. The result was prompt improvement in constitutional symptoms. Already in the early part of June she was able to resume her household duties. The heart had slowed down to nearly normal rate and the exophthalmos was receding. One month later, in July, 1925, following an acute nasopharyngeal infection, she developed a recurrence of symptoms. Accordingly, the course of radium treatments

Fig. 5. Case VIII. Severe exophthalmic goiter in a woman aged twenty-eight. Before radium treatment.

Fig. 6. Case VIII. After radium treatment.

was repeated. Again prompt improvement took place. A persistent moderate tachycardia made me repeat the course of treatments towards the end of 1925. In February, 1926, she was free from any evidences of Graves' disease except the persistence of exophthalmos. Reëxamination in November, 1928, found her in excellent health with barely perceptible exophthalmos.

Case VII. A. E., male, married, aged forty, was admitted to the Radium Clinic in November, 1925, complaining of all the classic symptoms of exophthalmic goiter of two and one-half years' duration. Basal metabolism plus 16 per cent. Blood Wassermann two plus. Circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 45 cm.

Course under radium treatment. After the first course of radium treatments to the thyroid and thymus regions given during November and December, 1925, there was prompt and rapid improvement but no complete retrogression of symptoms. Hence, a second course was given in January, 1926. Further improvement followed. Four months later, in May, 1926, he lost all his subjective complaints. The slight persistent tachycardia and thyroid enlargement made me decide to give him a third course of radium therapy. Following this third and last course of treatments the tachycardia gradually diminished, the exophthalmos began to recede and the blood Wassermann became negative without any antiluetic treatment. In March, 1927, the pulse rate was 72, the basal metabolism was normal, the circumference of the neck was reduced from 45 to 38 cm. Reëxamination in the early part of 1929 showed him to be in perfect health.

Case VIII. (Fig. 5.) Mrs. B. W., aged twenty-eight, first came under observation in May, 1926, complaining of severe symptoms of Graves' disease. Examination revealed marked bilateral exophthalmos. Pulse rate 140 per minute. Basal metabolism plus 62 per cent. Blood pressure: systolic 140, diastolic 40. Thyroid gland diffusely enlarged with predominant involvement of the right lobe. Circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 37 cm. Duration of illness nine and a half months.

Fig. 7. Case XII. Severe postoperative exophthalmic goiter in a girl aged fifteen and a half. Before radium treatment.

Fig. 8. Case XII. After radium treatment.

Course under radium treatment. During June and July, 1926, the patient was given with the block at 3 cm. distance 4500 mg-hr. of radium to the right lobe and 3000 mg-hr. to the left lobe of the thyroid and a similar dose to the thymus region. The result was prompt and striking improvement. Within one month after the treatment was completed she was able to resume all her household duties. The circumference of the neck was reduced from 37 to 34.5 cm. and the basal metabolism dropped from plus 62 to plus 10 per cent. However, the tachycardia persisted and a bruit was still present over the thyroid. Hence, a second course of radium treatments to the thyroid and thymus regions was given in fractionated doses during August and September. Further improvement followed and the exophthalmos began to recede. The circumference of the neck shrank to 33.5 cm. In December, 1926, with subjective complaints entirely absent, she still presented tachycardia and slight thyroid enlargement. Hence, a third course of radium therapy was carried out. The result was exceedingly gratifying. Examination on Feb. 1, 1927, showed complete recovery. The pulse and basal metabolic rate were normal. The circumference of the neck was reduced from the original 37 to 32.5 cm. Her appearance at this time is shown in Figure 6.

Towards the end of 1927 she gave birth to a healthy child. Four months later mother and baby were examined and were found free from any evidence of thyroid disturbance. Reëxamination in the early part of 1929 found her in excellent health with a gain of 40 pounds in weight and no symptoms of Graves' disease.

Case IX. A young woman, aged twenty, having a moderately severe case of Graves' disease, first consulted me in August, 1926. Following one erythema dose of high voltage roentgen therapy to each lateral lobe of the thyroid and to the thymus regions there was temporary improvement with prompt relapse. She was then treated with radium over the thyroid and thymus regions. The result was slow and gradual improvement. In May, 1927, eight months after radium therapy was started, her pulse came down to 72 per minute. The basal metabolism dropped from plus 25 per cent to normal rate. The circumference of

the neck was reduced from 37 to 33.5 cm., while her weight rose from 135 to 150 pounds.

She remained entirely free from any evidence of Graves' disease until the end of 1928. At this time, following an operation for a large ovarian cyst, she developed a recrudescence of her symptoms. These yielded promptly to further therapy. When last heard from in April, 1929, she was feeling well and had no toxic symptoms during the early months of pregnancy.

Case x. B. W., female, aged twenty-six, married, seen for the first time in June, 1926, had a severe case of Graves' disease with a basal metabolic rate of plus 52 per cent. After two courses of radium treatments directed to the thyroid and thymus regions she made a fairly rapid and complete recovery and has remained well to date. Of additional interest in her case is the observation that large diseased tonsils from which she had been suffering for a number of years became completely atrophied as an incidental result of the radium therapy directed towards the thyroid region only.

Case xi. Mrs. F. K., aged twenty-eight, a moderately severe case of Graves' disease of two years' duration, had been treated medically without any appreciable improvement. Operative intervention, repeatedly urged by the attending physicians, was invariably refused by the patient. Under radium therapy she made a satisfactory recovery. Last examination in the early part of 1929 found her entirely free from complaints and attending to all her duties. The thyroid gland was not palpable. The circumference of the neck was reduced from 34 to 30.5 cm. The exophthalmos had completely receded.

Case xii. (Fig. 7.) F. K., female, aged fifteen and a half, a severe postoperative case of exophthalmic goiter, first came under my observation in June, 1926. Four months after operation, with a marked drop from the previously high basal metabolic rate to nearly normal level, her clinical symptoms showed only slight recession. What radium treatments accomplished for this patient is shown in Figure 8, namely complete restoration to health. The last examination in April, 1929, failed to show any evidence of recurrence of symptoms.

Case xiii. B. W., female, aged thirteen, a classic case of exophthalmic goiter, was seen for the first time in August, 1927. The duration of symptoms was ten months, unrelieved by medical treatment. Thyroidectomy urged by the family physician was refused by the parents. Following two courses of radium therapy she made a prompt and complete recovery and has remained well since.

Case xiv. (Fig. 9.) Female, aged twenty-seven, one of the most severe cases of Graves' disease unrelieved by prolonged rest in bed and medical treatment, came under my observation in February, 1928. Duration of symptoms two years; complete disability one year.

Course under radium treatment. What radium therapy accomplished for this patient can be seen in Figure 10. Examination in October, 1928, failed to show any evidence of exophthalmos. The basal metabolism had dropped to normal from its initial 63 per cent and the pulse varied between 63 and 72 per minute. Nevertheless, in spite of apparently complete objective cure which was achieved by three courses of radium therapy, she still complained of slight fatigability on exertion. After further small fractionated doses of radium she gradually lost her residual complaints and in March, 1929, was able to resume the practice of her nursing profession.

Case xv. L. P., female, aged twenty-one, a moderately severe case of exophthalmic goiter of three years' duration, unrelieved by medical treatment, was first seen in March, 1928. Following the first course of radium therapy to the thyroid region there was improvement in constitutional symptoms, a gain of 10 pounds in weight and a drop in basal metabolism from plus 36 to plus 25 per cent. The exophthalmos, however, became more prominent. Under two more courses of radium treatments her symptoms receded almost entirely, the basal metabolism became normal and the exophthalmos was barely noticeable. When last seen in January, 1929, she still complained of slight fatigability and tachycardia on exertion. Objective examination elicited but few traces of active Graves' disease. Abdominal palpation revealed moderate tenderness in the right iliac fossa. Careful questioning then elicited a history of recurrent attacks of abdominal cramps and digestive disturbances strongly suggestive of appendicial disease. Surgical consultation was urged, but

Fig. 9. Case xiv. Severe exophthalmic goiter in a woman aged twenty-seven.

Fig. 10. Case xiv. After radium treatment.

the patient declared she felt too well to consider operative intervention for the present.

Case xvi. M. D., female, aged forty, was seen in consultation in August, 1928. Chief complaints, irritability, emotionalism, lachrymose condition, weakness, loss in weight, tachycardia and palpitation, goiter, exophthalmos and tremor. Duration of symptoms fifteen months. Examination revealed a diffuse enlargement of the thyroid gland with marked vascularity. The circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 33.5 cm. Basal metabolism plus 62 per cent.

Course under radium treatment. Following the first course of radium treatments with the collar at 3 cm. distance there occurred prompt and decided improvement in all symptoms and a drop in basal metabolism from plus 62 to plus 25 per cent. Complete clinical cure was achieved after the second course of radium therapy which was carried out in November and December, 1928. In January, 1929, the basal metabolism dropped to normal. The patient became free of all her complaints. Indeed, she declared she had not enjoyed such excellent health in many years.

Case xvii. Female, aged forty-four, married, had a severe case of Graves' disease of three years' duration. Examination revealed a diffuse and nodular enlargement of the thyroid gland with marked vascularity. Basal metabolic determination in the early part of August, 1928, showed plus 70 per cent. The blood pressure registered 170 systolic and 70 diastolic. Pulse rate 140 per minute.

Course under radium treatment. Prompt and marked improvement was noted after one erythema dose of radium with the radium collar at 3 cm. distance, given to the thyroid region. Complete clinical cure occurred after the second erythema dose. She gained 30 pounds in weight. The neck shrank from the original 35.5 to 34 cm. The basal metabolism dropped to normal. The systolic pressure came down from 170 to 140 and the diastolic pressure rose from 70 to 80.

Case xviii. This case is recorded to emphasize the fact that both surgery and radium therapy may fail to achieve a complete clinical cure in long standing cases of Graves' disease. This patient first came under my observation in February, 1925, several months after she

had undergone bipolar ligation, right cervical sympathectomy and thyroidectomy for a severe form of exophthalmic goiter treated medically without success for a period of three years.

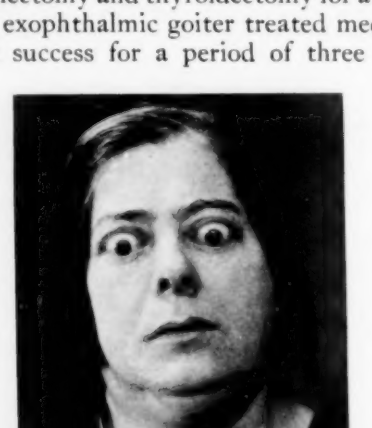

Fig. 11. Case xviii. A case of postoperative Graves' disease with persistent exophthalmos.

When first examined by me, in spite of a normal basal metabolic rate and marked gain in weight, she had a number of complaints usually associated with active Graves' disease. Although these symptoms were partially relieved by very small doses of radium the exophthalmos, as shown in Figure 11, fails to show any recession, nor has there been any recession since.

Comment. Undue delay in the local treatment of toxic goiter is undesirable. Although highly favorable results from radium therapy in Graves' disease have been obtained, even in severe and long standing cases, much better results are obtained in the earlier stages of the disease. To obtain a clinical cure in Graves' disease by radium therapy one or more courses may be required. Hence the patient is to be frankly told at the outset that the treatments may have to extend over a period of several months to a year and that several courses of treatment may have to be given before complete cure is achieved. Unless these facts are stressed and the patient's cooperation obtained many a potentially successful case will drop out before radium therapy has had a fair trial and will be registered as a failure of radium treatment per se, when more prolonged or adequate dosage would have resulted in the excellent clinical cures demonstrated in the series of cases presented above.

Nodular Toxic, or Toxic Adenomatous Goiter. This subject was dealt with comprehensively in a recent study.[4] Summarized, the conclusions were:

Neither clinically nor pathologically is there any fundamental distinction between toxic adenoma and exophthalmic goiter except as the variation of a single disease. Eponymically, Parry's disease—and not Basedow's or Graves' disease—is the most appropriate designation for toxic adenoma and exophthalmic goiter, for Parry is the first observer who described all varieties of toxic goiter. Clinically, a nodular goiter without exophthalmos may be as toxic or even more toxic than a smooth, diffusely enlarged or exophthalmic goiter with pronounced ocular signs. The prognosis in a severe case of toxic adenoma with myocardial insufficiency is much graver than in a moderately severe case of classic exophthalmic goiter with markedly bulging eyes and a myocardium fairly intact. Although toxic adenoma may run as severe a course as exophthalmic goiter, its clinical manifestations are usually milder and the surgical results more satisfactory than in classic exophthalmic goiter. The more favorable surgical results in toxic adenoma are not due to any fundamental difference in nature from exophthalmic goiter but to a variation of a single disease: In exophthalmic goiter the entire gland is usually involved in an individual who previously apparently was free from thyroid disease, while in toxic adenoma the thyroid gland shows one or more areas of involvement in a pathologic process with intervening healthy tissue between the affected areas. Hence the symptoms are usually milder and the surgical results more satisfactory than in diffuse hyperplastic or exophthalmic goiter. Surgery, however, is not the only means of successful treatment of toxic adenoma of the thyroid. All the various medical measures that have been found helpful in the management of classic exophthalmic goiter are of equal use in

toxic adenoma. Of the local agents contending for the most efficient modern treatment of toxic adenoma surgery has been recognized until the present day by the majority of the medical profession as the method of choice while röntgen and radium therapy have been disregarded. A review of the literature and our own case reports stress the fact: Surgery is no longer the only local means of relief in dealing with toxic adenoma of the thyroid. Radium therapy, efficiently used, relieves not only the toxic but also the compression phenomena in toxic adenoma of the thyroid. Radium therapy, safe, efficient, free from surgical mortality, ought to become henceforth the method of choice in dealing not only with exophthalmic goiter but also toxic adenoma of the thyroid.

Case xix. J. B., male, aged seventy-five, had had symptoms of thyrotoxicosis for five years. Examination revealed two large adenomas in the lateral lobes of the thyroid gland. The circumference of the neck measured 40 cm. Tachycardia was moderate with distinct auricular fibrillation. Basal metabolism plus 25 per cent.

Course under radium treatment. During the summer of 1925 the patient was given 6200 mg-hr. of radium with the block at 3 cm. distance over the adenomas and thymus region. Only one course of treatments in fractionated doses was given. Four months after treatment the thyrotoxic symptoms disappeared, including the auricular fibrillation. The basal metabolism dropped to normal. He gained several pounds in weight while the circumference of the neck was reduced from 40 to 35 cm.

Comment. Before coming under my observation, this patient was advised against operation on account of his advanced age and poor general condition. He was told he had better "let nature take its course." The result achieved by radium therapy in his case is an excellent demonstration that surgery is no longer the only method in dealing with toxic adenoma of the thyroid and that it is no longer necessary to "let nature take its course" in dealing with poor-surgical-risk cases of toxic adenoma of the thyroid. The last examination of this patient in April, 1929, found this man of eighty, five years after admission to the Radium Clinic of Beth Israel Hospital, in excellent health.

Case xx. Female, aged fifty, with a partly retrosternal toxic adenoma of the thyroid was seen for the first time in March, 1926. Duration of moderately severe toxic symptoms, five years. Circumference of the neck 35.5 cm.

Course under radium treatment. Following three courses of radium therapy given during 1926 and 1927 the thyrotoxic symptoms were relieved and the circumference of the neck shrank from 35.5 to 31.5 cm. while her weight rose 11 pounds. Reëxamination in the early part of 1929 found her in good health and attending to all her domestic duties.

Case xxi. Y. K., female, aged forty-eight, a case of postoperative recurrent toxic adenoma of the thyroid with mediastinal compression phenomena, first came under my observation in December, 1926. For one year she had been suffering from moderately severe toxic symptoms unrelieved by medical and several low voltage roentgen treatments. Examination revealed a diffuse and nodular enlargement of the thyroid gland with dilatation of veins over the lower anterior neck and upper chest. The circumference of the neck measured 34.5 cm. Basal metabolism plus 58 per cent.

Course under radium treatment. After two erythema doses of radium with the collar at 3 cm. distance, giving during the Spring and Summer of 1927, there was marked improvement in constitutional symptoms. The basal metabolism dropped from plus 58 to plus 6 per cent. Her weight rose from 118 to 129 pounds, while her neck shrank from 34.5 to 32.5 cm., with disappearance of the dilated veins over neck and thorax.

Case xxii. Female, aged twenty-eight, married, first applied to the Radium Clinic of Beth Israel Hospital in February, 1927. Duration of mild toxic symptoms for nearly eight years, severe toxic symptoms for three months. Basal metabolism plus 52 per cent. Circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 36 cm.

Course under radium therapy. Four months after a single dose of 6000 mg-hr. of radium administered during a period of five days she lost all her subjective complaints. Her pulse came down to 72 per minute. The basal metabo-

lism became normal. She gained considerably in weight. Her neck shrank from 36 to 33 cm. No recurrence of symptoms three years later.

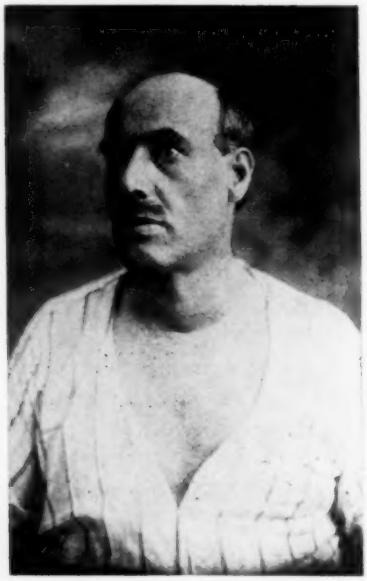

FIG. 12. Case XXIV. Severe postoperative toxic adenoma of thyroid in a man aged fifty.

CASE XXIII. B. O., female, aged thirty-two, married, suffering from thyrotoxic symptoms with marked mental manifestations recurring in attacks. Examination revealed a nodular enlargement of the thyroid gland. Circumference of the neck through the 7th cervical vertebra and the mid-thyroid region measured 33 cm. Moderate tachycardia. Basal metabolism plus 30 per cent.

Course under radium treatment. Within three weeks after a single erythema dose of 6000 mg-hr. of radium with the collar at 3 cm. distance, there was marked improvement in constitutional symptoms and a decided change in facial expression. The melancholic look was gone. She felt more cheerful. Her strength improved greatly. Her pulse dropped to 72 per minute. The basal metabolism became normal. She gained several pounds in weight. The circumference of the neck was reduced from 33 to 30.5 cm. No recurrence of symptoms since.

CASE XXIV. (Fig. 12.) Male, aged fifty, with severe postoperative toxic adenoma of the thyroid. Six months after partial thyroidectomy all the thyrotoxic symptoms persisted unabated. During the fall of 1927 he was given three courses of radium treatments. There was only slight relief and the patient became fretful at the slow improvement noted. Hence, without even waiting for the erythematous reaction from the third radium treatment to subside, he went to the Cleveland Clinic to obtain a quick cure by further surgery. The operation, subtotal thyroidectomy, was performed by Dr. G. W. Crile in December, 1927. The patient returned to New York in January, 1928, and remained under my constant observation for one year. In spite of subtotal thyroidectomy he still presented toxic symptoms and was unable to resume his work in July, 1928, or nearly seven months after the second operation.

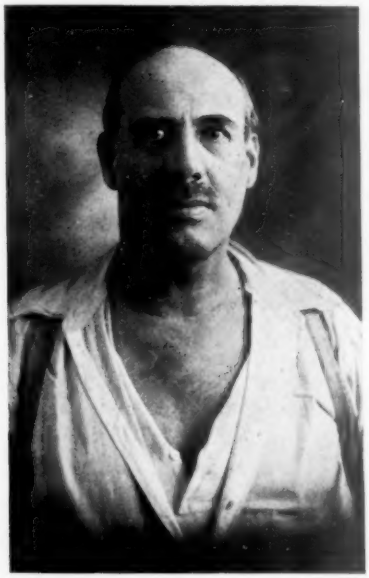

FIG. 13. Case XXIV. After radium therapy and reoperation.

Comment. The clinical behavior of this case serves to emphasize the following two important lessons: (1) A severe case of toxic adenoma of the thyroid may be very resistant to all forms of treatment—irradiation as well as operation. (2) Radium therapy properly carried out does not make subsequent operation on the thyroid a more difficult task even in a case previously thyroidectomized. The cosmetic result after radium and reoperation is shown in Figure 13.

Malignant, or Cancerous Goiter.

Case xxv. H. S., male, aged forty-four, first came under my care in July, 1923. For a period of five years, until the end of 1922, he had a progressive enlargement of the neck which on repeated medical consultations was diagnosed benign goiter. In December, 1922, he suddenly developed a pathologic fracture of a rib. But even this significant lesion failed to stir any suspicion in the minds of the attending and consulting physicians about the possible malignant character of the thyroid growth Only many months later, in 1923, when he developed hemoptysis, did roentgen examination of the chest lead to the discovery of a tumor mass at the site of the pathologic fracture. The biopsy of this tumor diagnosed as round and spindle cell sarcoma raised for the first time the question of a possible relation between the thyroid growth and the bone tumor. Further roentgen studies revealed extensive skeletal metastases. One of these metastatic lesions in the skull led to complete destruction of the bone with perforation to the dura, yielding an impulse on coughing. Under radium treatment the bone defect in the skull closed completely. New bone formed at the site of destruction. The other metastatic areas in the skeleton were kept almost completely in check the next four years by roentgen therapy. The thyroid gland, the carcinomatous nature of which was revealed by further biopsy, shrank under the therapeutic effects of radium and roentgen therapy. The patient finally succumbed to brain metastases in 1927, ten years after the thyroid tumor had first been discovered and four years after extensive skeletal metastases had been revealed on roentgen examination.

Comment. The history of this patient, which recounts the usual clinical behavior of thyroid malignant growths, emphasizes the following important lessons:

1. Malignant tumors of the thyroid gland may grow progressively for a period of five years and more without causing any pressure phenomena, invasive growth or impairment of general health.

2. The first evidence that apparently a "simple adenoma" is merely a slowly growing malignant thyroid tumor may be disclosed by the appearance of metastases in the bones, lungs or other organs.

3. The current belief in medical circles that 90 per cent or more of thyroid cancer develops on the basis of preëxisting simple adenoma may or may not be correct. The observation, however, that for many years a thyroid cancer may be indistinguishable in its clinical characteristics and behavior from a simple adenoma, is a well-established fact.

4. Already in the so-called early stage of thyroid cancer frequent metastases occur in the skeleton and other organs.

5. The great difficulty, if not impossibility, of clinically diagnosing thyroid cancer in its local stage before general dissemination has occurred, renders every form of therapy directed to the thyroid region only of mere palliative value. This applies not only to surgery, radical or otherwise, but applies equally to radium and roentgen therapy.

6. A careful review of the literature shows that radical surgery has failed to produce permanent cure of thyroid cancer even when operated on in the so-called early stage of the disease.

7. The surgical mortality in definitely diagnosed thyroid cancer runs very high. It was no less than 25 per cent at Crile's Clinic[10] and 30 to 66 per cent in some of the European clinics.[12] Hence surgical extirpation can only have its appeal in the absence of any other superior method.

8. Radium and roentgen therapy efficiently employed have given superior results to operation in the treatment of primary and metastatic malignant thyroid tumors, as shown in the reports of Klose and Hellwig,[8] Schaedel,[11] Perthes,[9] Holfelder,[6] Holzknecht,[7] Portmann,[10] Bowing,[2] and others. The two most interesting reports come from the Mayo[2,13] and Crile clinics. These are briefly summarized in Tables I and II. The observation at both these clinics that a combination of operation plus irradiation is superior to any single method is highly interesting and

TABLE I
(Modified after Portmann[10])
RADIATION THERAPY IN MALIGNANT DISEASE OF THE THYROID GLAND
Comparative Summary of Results of Treatment of Malignant Growths of Thyroid

	Total Cases	No Trace	Operative Mortality	Dead 1–5 Years	Alive 1–5 Years
Operation only	44	7 15.9%	11 25 %	18 40.8%	8 18.1%
Radiation only	28	5 18 %	1 3.6%	13 46.4%	10 37.8%
Operation plus radiation	53	8 13.2%	1 1.8%	16 27.2%	29 52.4%

TABLE II
(Modified after Wilson[13] and Bowing[2])
RADIATION THERAPY IN MALIGNANT DISEASE OF THE THYROID GLAND
Comparative Summary of Results of Treatment of Malignant Growths of the Thyroid

	Total Cases	No Trace	Operative Mortality	Average Duration of Life
Operation only (Wilson)	207	13	?	18 months
Radiation only (Bowing)	76	5	?	21 months
Operation plus radiation	91	4	?	45 months

instructive. This observation would have been even more instructive had the authors given us an insight as to why this combination proved superior to the single use of either one of these methods. However, even in the absence of any such information concerning the relative share each agent contributed to these superior results, the value and place of irradiation in the treatment of thyroid cancer is thus forcibly brought to light.

SUMMARY AND CONCLUSIONS

In a series of some 500 goiter patients studied intensively during the years 1922 to 1928 the following five groups were encountered: (1) Diffuse nontoxic, or simple goiter; (2) nodular nontoxic, or simple adenomatous goiter; (3) nodular toxic, or toxic adenomatous goiter; (4) diffuse toxic, or exophthalmic goiter, and (5) malignant, or cancerous goiter.

Group 1 was treated entirely by general medical measures plus iodides and was not subjected to radium therapy.

Patients with simple adenomatous goiter were classified into two types: (*a*) juvenile; (*b*) adult. Only the juvenile group was dealt with in the present communication. These juvenile patients showed very encouraging results from radium therapy.

In exophthalmic goiter clinical cure of a lasting kind has been obtained not only by implanting radium interstitially into the thyroid gland but also by external application of properly screened radium.

Neither clinically nor pathologically is there any fundamental distinction between a toxic nodular goiter—toxic adenomatous goiter—and diffuse toxic goiter—exophthalmic goiter—except as the variation of a single disease. In exophthalmic goiter the entire gland is usually involved in an individual who previously was apparently free from thyroid disease, while in toxic adenomatous goiter the thyroid gland shows one or more areas of involvement in a pathologic process with intervening healthy tissue between the affected areas. Hence the symptoms are usually milder and the surgical results more satisfactory than in diffuse hyperplastic or exophthalmic goiter. Surgery, however, is not the only local means in the successful treatment of toxic adenomatous goiter. Radium therapy, efficiently used, relieves not only the toxic but also the compression phenomena in toxic adenomatous goiter, or toxic adenoma of the thyroid.

Early clinical diagnosis of cancer of the thyroid before general dissemination has occurred, is extremely difficult, if not impossible.

Radical surgery has failed to produce permanent cure of thyroid cancer even when the operation was performed in the so-called early stage of the disease. Hence radical surgery with its extremely high mortality is only of palliative value in definitely diagnosed thyroid cancer.

The end-results of surgery in thyroid cancer would only justify the method in the absence of any superior method.

Radium and roentgen therapy efficiently

employed has yielded results superior to operation in the treatment of primary and metastatic thyroid cancer.

The observation in some clinics that a combination of operation plus irradiation has given better results than the single use of either method requires further study. Nevertheless, the great value and place of irradiation in the treatment of thyroid cancer is thus definitely established.

REFERENCES

1. Aschoff, L. The Goiter Problem. Lectures on Pathology. Paul B. Hoeber, New York, 1924, pp. 313–339.
2. Bowing, H. H. Malignant tumors of the thyroid gland treated by operation, radium and roentgen rays. Am. J. Roentgenol. & Rad. Therapy, 1927, *18*, 501–508.
3. Ginsburg, S. Thyrotoxicosis in childhood; early diagnosis and radium therapy. *Am. J. Dis. Child.*, 1929, *37*, 923–943.
4. Ginsburg, S. Toxic adenoma of thyroid. *Arch. Int. Med.*, 1929, *44*, 73–117.
5. Ginsburg, S. Radium treatment of exophthalmic goiter. To be published.
6. Holfelder, H. Die Erfahrungen mit der Röntgentherapie der malignen Tumoren an der Schmiedenschen Klinik. *Strahlentherapie*, 1923, *15*, 715–731.
7. Holzknecht, G. Schielddrusen Karzinom und Röntgenbestrahlung. *Wien. klin. Wchnschr.*, 1924, *37*, 419–420.
8. Klose, H., and Hellwig, A. Die Struma maligna. *Klin. Wchnschr.*, 1922, *1*, 1687–1691.
9. Perthes, J. Zur Biologie und Klinik der Röntgentherapie der chirurgischen Krebse. *Strahlentherapie*, 1923, *15*, 695–714.
10. Portmann, U. V. Radiation therapy in malignant diseases of the thyroid gland. *J. Am. M. Ass.*, 1927, *89*, 1131–1135.
11. Schaedel, W. Ueber Struma maligna. *München. med. Wchnschr.*, 1922, *69*, 1282–1285.
12. Sudeck, F. Ueber die Behandlung des Morbus Basedowii und der Struma maligna mit Röntgenstrahlen. *Deutsche med. Wchnschr.*, 1918, *44*, 1104–1105.
13. Wilson, L. B. Malignant tumors of thyroid. *Ann. Surg.*, 1921, *74*, 129.

DISCUSSION ON PAPERS OF DRS. LOUCKS AND GINSBURG

Dr. Henry J. Ullmann, Santa Barbara, Calif. A few weeks ago I saw an abstract of a German article in which a warning was given against using Lugol's solution before irradiation, and I wish to ask each of the essayists his opinion on this.

One very important point not discussed in either of these papers, but which receives much attention among my colleagues at home, pertains to the selection of surgery, which can be performed at once, or irradiation, which requires six months to a year before the patient receives the full benefit of treatment. In a case of hyperthyroidism with marked toxic changes and in which it is important to get immediate relief from toxicity, a good internist and a good goiter surgeon both believe that there is little difference in the ultimate results between surgery and irradiation and that the mortality from surgery is no greater than that from an overloaded heart during the time required for irradiation.

I was much interested in Dr. Ginsburg's treatment of the simple, nodular, juvenile adenoma, because I felt, as most physicians do, that the treatment of simple goiter in the child by irradiation is a risky procedure. I judged from Dr. Ginsburg's report that it is not. I noticed from the illustrations that many of the patients did not show complete retrogression of the exophthalmos. I believe that it is always wise to warn patients that while we expect to relieve the toxic condition, we cannot offer any definite prognosis in regard to the exophthalmos. I am using the roentgen ray instead of radium because it happens to be a little easier for me as my radium is apt to be in use in the treatment of malignant cases, but I use high voltage with copper filter. A month or two ago a patient to whom I had given several treatments of short wave radiation received one treatment with an equivalent dose of low voltage, aluminum filtered roentgen rays. There was much more reaction from this than from the heavily filtered treatment, and I returned to the latter with the original absence of reaction. I start with a small dose if there is much toxicity and treat every day or two until I have given my full dose which is 700 r, including back-scattering, and allow for 7 per cent per day loss.

We must bear in mind that a patient may

have a pulse of from 100 to 120, be nervous and high strung but without tremor and with clinically a definite mild hyperthyroidism, but with a basal metabolic rate of −20. Such a patient of mine had had the ovarian function modified by radium treatment for uterine fibroids. She was given one-quarter grain of thyroid extract three times a day. The basal rate came up to normal, the nervousness disappeared and the pulse dropped to below 90. I discussed this case with Dr. Engelbach of St. Louis and he told me that he had observed such a syndrome and thought it was due to an imbalance between the ovary and the thyroid. It is, therefore, probably a lowered ovarian function giving hyperthyroid symptoms with an actually lowered thyroid function.

With regard to the eczema of the ears spoken of by Dr. Ginsburg, one must consider the possibility that the change in metabolic rate had as much to do with the cure of eczema as the irradiation. Either one will effect eczema. I have many cases only slightly improved by irradiation, who give suggestive histories of protein sensitization, and whose eczemas cleared up nicely on giving enteric coated pancreatin over a period of a month or more.

DR. G. ALLEN ROBINSON, New York City. My experience with a considerable number of these patients has not been entirely pleasing, because of the difficulty in reducing the size of the thyroid. Even though patients are told that their necks will not go back to normal, still they expect it. Again I have seen skin changes in some of the cases, and even with moderate doses of radium. I think if Dr. Ginsburg has not seen this he will. It is disfiguring to say the least, and whether or not a smooth scar is preferable to these changes is for the profession to decide. It seems to me that surgery in the thyroid has been so uniformly successful that with the pitfalls and difficulties in reducing the tumor mass with radium, irradiation may not be the treatment of choice. In the treatment of malignancy of the thyroid I think we have all obtained excellent results by a combination of surgery and radium.

DR. G. W. GRIER, Pittsburgh, Pa. I would like to ask Dr. Ginsburg whether in the treatment of the little girls time enough has elapsed to know whether there has been any influence on puberty, or the development of the children.

DR. H. H. BOWING, Rochester, Minn. I wish to discuss Dr. Ginsburg's paper and especially refer to the combined method of treatment of carcinoma of the thyroid gland. As a rule, the pathology encountered in malignant disease of the thyroid gland makes the combined methods necessary. For example, in one type of malignant disease of the thyroid gland, the tumor is very cellular and it is astonishing to see what effects may be produced and to what degree palliation will occur with the application of radium surface packs; however, when necrosis is present surgery is indicated. Further, a papillary carcinoma of the thyroid gland is usually of a low grade malignancy and in some cases, becomes cystic in areas. In this event a combination of surgery and irradiation seems indicated. Palpation of the thyroid tumor field may elicit these areas of necrosis and cystic change and thus determine the best procedure to employ for the case under consideration.

DR. LOUCKS (closing). Regarding Lugol's solution, this is valuable but dangerous, as I mentioned. It should not be given in any kind of a goiter for more than ten days or two weeks. It should not be given during irradiation. There is an activity of the thyroid gland at the time of irradiation and Lugol's solution makes the condition worse.

The bad cases of toxic thyroid, with a high metabolic rate, high pulse, and all the other symptoms given by Dr. Ginsburg, are bad surgical risks and men with a good surgical reputation, such as Crile and the Mayos I think would not operate in those cases. They start to respond within six months to irradiation and it takes that long for surgery to give full results, or longer.

It would take too long to go over my complete technique. I have not changed it, except that I use varying amounts of radium—never less than 100 mg.; never more than 180 mg. With my technique I can place the radium over the tumor, or can give it substernally. Your clinical experience will tell you whether one side needs more irradiation than the other. Some cases need 1200 mg-hr. and some will need only 800 mg-hr., for either side.

The differentiation between a functional activity and a toxic thyroid is the great point.

As I mentioned in my paper, physiological activation may come from many things, an automobile accident, shock of any kind, influenza, etc. If the patients are given rest treatment, an ice collar, forced feeding, and Donovan's solution, which contains a small quantity of iodine, they improve. This solution should be given for three weeks and then they should rest for three weeks without it. Very little medication is required at any time with the treatment. Many times we have to carry a patient along with digitalis, luminal or something to give them an appetite, or there may be an acidosis which requires treatment.

Dr. Ginsburg (closing). For a more detailed discussion of the association of increased pulse rate and minus metabolic rate in patients with Graves' disease, I wish to refer Dr. Ullmann to my paper on "Thyrotoxicosis in Childhood; Early Diagnosis and Radium Therapy," which appeared in the *American Journal of Diseases of Children* in May, 1929. Here I briefly wish to state that in several cases of classic Graves' disease I have observed the association of a minus basal metabolic rate with increased pulse rate and other toxic manifestations of the disease. In a recently studied case of exophthalmic goiter with very high basal metabolism the rate dropped to minus 20 per cent after deep roentgen therapy. But the tachycardia and many of the toxic symptoms persisted in spite of the lower basal metabolic rate. Moreover, the observations of Plummer, Kessel, Jackson, and others, that the administration of thyroxin to patients with severe thyroid crisis instead of aggravation may cause marked amelioration of the thyrotoxic symptoms and actually prove life-saving, strongly militate against the current popular theory that Graves' disease is almost invariably synonymous with hyperthyroidism. Regarding eczema of the ears which cleared up after radium therapy directed to the thyroid, the result may have been coincidental or secondary to general improvement. However, my repeated observation that following radium therapy to the thyroid region many a large tonsil had shrunk considerably in size, appears to justify the belief in this case that the eczema probably cleared up as the result of the radium rays, the potency of which extended beyond the immediate area of application.

As to the late scarring which Dr. Robinson is afraid of, I wish to assure him that the technique outlined in my paper is a perfectly safe method of treatment. I have followed my patients from one to four and a half years and have observed no scarring. That mild telangiectasis may occasionally occur, I shall not dispute. Thus far, however, the results from this technique have been very gratifying.

In reply to Dr. Grier's question, I wish to state that the number of children treated to date has been about twenty. In these I have not noticed any subsequent abnormality either in physical or mental development. Moreover, if we consider the precentage depth dose at 2 or 3 cm. from the skin surface which, according to the calculations of Dr. Schwartzchild, the physicist at the Beth Israel Hospital, averages between 40 and 50 per cent of the skin erythema dose, we need have no fear that the technique used will completely destroy the thyroid in these juvenile patients and be followed by myxedema and hypovarian function.

BARIUM ENEMA ENTERING ESOPHAGUS*

CASE REPORT

By CLINTON G. LYONS, M.D.
Roentgenologist, United States Veterans' Bureau Hospital
HINES, ILLINOIS

THE following case is reported primarily because of the exceeding rarity of the condition. A search through modern textbooks and literature fails to reveal a similar case recorded.

Male, aged thirty-five, white, married; occupation, coal miner.

Family History. Mother and father living and well. One brother and two sisters living and well. One sister died at age of fourteen with goiter. Patient has 3 children. No trace of insanity, cancer or tuberculosis.

Personal History. Patient had ordinary childhood diseases. Received broken leg (left) when about three or four years old. Had typhoid fever at age of fourteen. Patient states he has had stomach trouble since date of entering the Army. Was a patient in Hospital No. 35, St. Louis, Mo., for two months in 1923, and was treated for duodenal ulcer. In Hospital No. 67, Kansas City, Mo. for three months, 1925, received treatment and operation for duodenal ulcer. In Hospital No. 67, Kansas City, for three months in 1928, treatment for duodenal ulcer. Patient states that operation for duodenal ulcer was performed at St. Joseph's Hospital, Ottumwa, Iowa, in 1925. Tonsils removed at Hospital No. 67, Kansas City, in 1928. Smokes cigarettes, does not use drugs or alcohol. Denies any venereal disease.

Military History. Enlisted May 28, 1918, Camp Dodge, Iowa. Assigned to Co. H. 349th Inf. Overseas for nine months. Was treated for stomach trouble for three weeks in a hospital in France. Had light attack of influenza in France. No other illness or injury in service. Discharged Camp Dodge, Iowa, June 11, 1919.

Present Illness. Has had stomach trouble for past eleven years. Onset gradual with pain one hour or more after meals, relieved temporarily by taking food. Had gastroenterostomy in 1925, and has not had pain since then. Has vomited and had diarrhea for the past three years, blood in stools on several occasions from tarry consistency to bright red; belches a great deal and has gas in bowels. Vomitus and gas belched have very foul odor.

Chief Complaint. On admission—vomiting, diarrhea, loss of weight, weakness.

Physical examination, Oct. 24, 1929, revealed an emaciated white male, acutely ill. Height and weight not taken. The skin appeared dry. There was a scar in the upper right abdominal quadrant which was well healed. The eyes were negative, pupils normal. Three teeth were missing, caries of one tooth, and salivary deposits. The chest was of medium length, narrow, flat, musculature poor, expansion poor and equal. The lungs were normal, heart, normal; pulse, 104; blood pressure, 110/70. The abdomen showed tenderness in the epigastrium to the right of the midline; no rigidity or masses felt. There was edema of the scrotum and a pitting edema of lower extremity. No enlargements were noted in the glandular system. Examination of the reflexes showed the knee joints sluggish.

A diagnosis of gastrocolic fistula and secondary anemia was made.

Surgical Consultation:—

History. Patient's chief complaint is vomiting, loss of weight, and diarrhea, which has been present for at least two years, but much worse during the last few months. The vomitus is frequently fecal in type and he states that the food that he has eaten passes right through within a short time and many particles of it can be recognized in the stools. He has no pain. Occasionally his stools are tarry-like. He had a gastroenterostomy in 1925.

Examination. Patient is emaciated, anemic, and there is a pitting edema of both legs and perhaps slightly of one hand. The abdomen is flat and soft throughout. There is an upper right rectus operative scar. There is some tenderness in the epigastrium.

Laboratory Findings. Urinalysis, negative; Wassermann and Kahn reactions, negative; blood examination: Hb., 70 per cent; red blood cells, 3,500,000; white blood cells,

* Published by authority of Dr. Winthrop Adams, Medical Director, United States Veterans' Bureau.

11,800; polymorphonuclears, 88 per cent; small and large lymphocytes, 12 per cent. Examination of feces negative.

Roentgen Findings.

Roentgenoscopic Examination: Opaque enema filled rectum and sigmoid to a ballooning. The head of the barium column pursued a central vertical climb to a proximal distance of 15 cm., looping downward and outward to the left lower quadrant of the abdomen, where many loops were formed with slight ballooning, causing the patient to complain of distress. The head of the column took a high and rapid climb from this region to the splenic flexure. At this point the colon was ballooned throughout and the contents of the enema can was exhausted. With additional barium the opaque enema caused distention of the splenic flexure and many small streams of barium were seen extending downward and inward, crossing the abdomen in various directions, attributed to barium entering and filling the convolutions of the small intestine. A column of barium was observed in an upward climb entering and filling the stomach through a gastroenterostomy. The barium meal was also visualized in the lower third and middle of the esophagus. The patient later vomited a barium mixture.

The roentgenographic examination confirms the roentgenoscopic findings showing on the immediate films large areas of barium throughout the left abdomen filling the small intestine, stomach, descending colon, sigmoid and rectum. A small amount of barium is seen in the first portion of the duodenum, and esophagus (Fig. 1).

Fig. 1. Showing the barium enema filling the rectum, sigmoid, colon, jejunum, stomach and esophagus.

Conclusion: Gastro-jejuno-colic fistula.

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EDITORIAL

THE GOULSTONIAN LECTURES ON CALCIUM AND PHOSPHORUS METABOLISM

THE Goulstonian Lectureship commemorates the name of Theodore Goulston, a Fellow of the Royal College of Physicians who died in the year 1632, leaving a bequest of £200 to the Royal College of Physicians for the maintenance of an annual pathological lecture. "This was to be read sometime between Michaelmas and Easter, by one of the four youngest doctors of the college. A dead body was, if possible, to be procured, and two or more diseases treated of, upon the forenoons and afternoons of three successive days."* The first Goulstonian Lecture was given in 1639 and for almost three hundred years, except for a few breaks owing to the Civil War, the late war, and other causes, it has been given annually.

The 1930 Goulstonian Lectures were given by Dr. Donald Hunter, who chose for his topic "The Significance to Clinical Medicine of Studies in Calcium and Phosphorus Metabolism,"† and in a critical and careful review he summarizes the present knowledge of this important subject and gives indications of its practical value to clinical medicine.

For a long time it has been known that calcium is an element essential to the life of plants and animals, the green parts of plants being especially rich in calcium, from which source herbivorous animals obtain principally the calcium essential to their maintenance. Man, on the other hand, derives most of his calcium from milk, cheese, butter, eggs, green vegetables and nuts, and calcium exists in our food in both organic and inorganic combinations. "It is probable that digestive changes convert it entirely into the inorganic form so that it is absorbed as calcium salts partly or completely ionized." It is well known that an excess of calcium in the diet is desirable for the reason that the interaction with carbonates of the digestive juices reconverts some of the ingested calcium into insoluble carbonate, which escapes absorption and is lost in the stools. The primary function of calcium in the body is the formation of bone but, as Hunter points out, it has perhaps been insufficiently emphasized that the skeleton of the mammal is not only a supporting structure but is also a reservoir of calcium and phosphorus and that "even after full growth is complete, bone salts are being continuously removed and renewed, and they are not once and for all laid down and fixed." Since bone is a considerable store house of calcium the skeleton can be drawn upon not only when there is a calcium deficiency but apparently also in a normal procedure such as the production of milk.

Not only does calcium play an important part in the formation of the skeleton, but it has an additional rôle by maintaining along with other ions a balance system which determines the irritability of muscle and nerve and in this way calcium ions help to control the heart beat, the contractility of plain and striped muscle and the transference of impulses at the neuromuscular junctions and through synapses.

Since phosphorus plays such an important part in the utilization and storage of calcium a knowledge of the metabolism of phosphorus is also essential to a clear understanding of these functions. Phos-

* Hutchinson, Benjamin. Biographica Medica. Volume I. J. Johnson, London, 1799, p. 367.

† *Lancet*, Apr. 26, 1930, *1*, 879–905; May 3, 1930, *1*, 947–957; May 10, 1930, *1*, 999–1008.

phorus compounds take part in at least four important metabolic processes: they are in some way essential to the utilization and storage of carbohydrates; they play a part in the chemical changes which precede the contraction of muscle; they are concerned with the acid base equilibrium and are essential to the formation of bone. "These manifold requirements and functions depend, also, on the integrity in which an accessory food factor, vitamin D, the internal secretion of the parathyroid glands, and an enzyme called phosphatase, play their part."* The normal biological process of ossification and the maintenance and repair of bone in the adult is little known. Hunter agrees with Robison, Kay and their collaborators that there is no doubt that phosphatase plays an important part in these two processes, and also that phosphatase may play an important part in some generalized diseases such as osteitis fibrosa cystica, secondary carcinomatosis of bone, and rickets.

Of particular interest to the clinician and the roentgenologist is the discussion of the part played by the parathyroids in calcium metabolism and its effect on the skeleton. MacCallum and Voegtlin were the first to demonstrate a reduction in the calcium content in the serum after parathyroidectomy. It remained for Collip to isolate an active extract of the parathyroid glands and injections of this substance abolished tetany in parathyroidectomized dogs, the serum calcium being restored to normal. It was demonstrated that the administration of Collip's extract to normal dogs raises the serum calcium above normal to such an extent as to make this a means of standardization.

Hunter and Aub, in their studies on lead poisoning, found that injection of parathyroid extract causes a loss of calcium from the bones and were enabled by these studies to clear up certain questions in calcium excretion which led to their conclusion that certain cases of generalized osteitis fibrosa cystica in which there is a diminished density of the bones and a high calcium content of the serum were due to lesions of the parathyroid glands. A number of cases of generalized osteitis fibrosa cystica have been recorded in which parathyroid tumor was found, in which after a removal of the tumor there was a distinct lessening in the calcium content of the serum and the bones became more dense.

It has been known for some time that in exophthalmic goiter the density of the bones is diminished and that the excretion of the calcium is greatly increased but that in these hyperthyroid cases the level of the calcium in the blood does not rise. Hunter was unable to offer an explanation for this phenomenon. Turnbull, in his histological observations on the long bones, both in cases of exophthalmic goiter and of hyperactivity of the parathyroids, found that the diminished density of the bone is due to lacunar resorption by osteoclasts and is distinctly different from the diminished density seen in rickets and osteomalacia in which less calcium is laid down in the osteoid tissue.

Hunter, after his studies on the relation of the parathyroid glands to generalized osteitis fibrosa cystica, continued his studies on the more common form, focal osteitis fibrosa, a disease which affects one or more bones but is usually not disabling, its progress being slow and having a tendency to become arrested. It is a disease occurring principally in adolescents and may be symptomless until spontaneous fractures occur. In all the cases of focal osteitis fibrosa cystica which he investigated he found the serum calcium and the plasma phosphate and phosphatases to be normal. These findings are of considerable importance in these cases in that apparently the parathyroids are not directly concerned in the focal type of osteitis fibrosa and that in this type

* Editorial, Calcium and phosphorus, *Lancet*, May 10, 1930, *1*, 1022–1023.

"exploration of the neck is unjustifiable."

Most observers are agreed that in rickets and osteomalacia the essential abnormality is the same, that is, a deficient calcification of the osteoid tissue; that osteomalacia is really a manifestation of rickets in adult life; that both diseases are distinctly concerned with the storage of vitamin D, and that in the majority of cases there is an actual calcium deprivation. Also in both diseases the phosphorus content of the plasma is low and in both the abnormalities in the blood are promptly restored to normal by the use of cod-liver oil, ultraviolet light or irradiated ergosterol and quite promptly ossification begins to proceed normally.

Hunter discusses other diseases of bone and indicates that estimations of the phosphatase content of the plasma may lead to important advances in our knowledge of some skeletal diseases which are obscure at the present time. For example, osteitis deformans has been observed for a long time but little was known of its etiology until Kay showed that phosphatase is always in excess in the plasma in this disease.

Hunter and Aub in their studies on lead poisoning have shown that lead, mercury, arsenic, silver and radium follow calcium very closely in their behavior both as to storage in the bones and their elimination, and this knowledge they applied in the treatment of lead poisoning; Flinn and Seidlin in their treatment of radium cases with parathormone extract report a phenomenal increase in the rate of elimination of the radium, showing a close connection between radium and calcium storage and elimination unless, as they suggest, one makes a bold assumption that parathormone exercises a specific therapeutic action on radium fixed in the bony skeleton, but since Hunter and Aub have made almost identical observations as regards the excretion of lead after the injection of parathormone it must be admitted that the good results obtained in its injection in these cases are due entirely to its influence on calcium metabolism.

Hunter, in his discussion of calcium and phosphorus metabolism, calls attention to the rather interesting observation that Styfsiekte or "stiff sickness" of cattle is a disease which has to do with phosphorus deficiency. This "stiff sickness" is very prevalent in South African cattle; the disease occurs in Minnesota and is probably identical with the "Grand Traverse disease" of Michigan, "impaction paralysis" and the "cripples" of Australia and "Midland disease" of Tasmania. The work of Sir Arnold Theiler has shown this to be a disease comparable to osteomalacia of the low phosphorus type and is curable by the addition of phosphates to the diet. The animals most affected are heifers with the first calf, cows in lactation, and growing cattle. The animals "develop an intense craving for bones, a symptom which is termed osteophagia. This compels them to travel long distances to find carcasses to eat, and they may even kill and eat young lambs. On the Veld they may sometimes be seen and heard in the distance crunching bones. The disease shows itself in retardation of growth and abnormal skeletal development, the most obvious features of which are the thickening of the epiphyses of the leg bones, most pronounced at the metacarpus and first phalangeal joints. The gait is stiff and lame. . . . . "Styfsiekte is therefore rickets or osteomalacia of the 'low phosphorus' type produced by a mass experiment of Nature in areas where the soil and grass are deficient in phosphorus." Sunlight is unable to prevent its occurrence and the routine preventive is bone meal. Milk fever of cows is associated with a low calcium content of the serum and can be successfully treated by calcium injections.

Hunter comments on the disappointing results of calcium administration as a therapeutic agent and points out the fact that there is a constant supply of calcium in the food and a large supply available

in bones but that the regulating mechanism is at fault and when this mechanism breaks down the tissues suffer from calcium deficiency, this being the reason why cod-liver oil, ultraviolet light, irradiated ergosterol, parathyroid or thyroid extract is often of greater value than the direct administration of calcium salts.

The studies of calcium and phosphorus metabolism are so involved that only those who are directly interested can hope to gain any extensive knowledge of them except where they touch more acutely their clinical application. To roentgenologists who are constantly having to deal with and interpret bone densities it is of extreme importance that the various etiological factors in the production of bone densities be kept in mind in order that a proper interpretation may be made. Such studies as Dr. Hunter and his collaborators have been engaged in point the way to the further elucidation of other still obscure bone manifestations.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

AMERICAN ROENTGEN RAY SOCIETY
Secretary, Dr. John T. Murphy, 421 Michigan St., Toledo, Ohio.
Thirty-first annual meeting: West Baden Springs Hotel, West Baden, Indiana, Sept. 23–26, 1930.

AMERICAN COLLEGE OF RADIOLOGY
Secretary, Dr. Albert Soiland, 1407 S. Hope St., Los Angeles. Calif.
Annual Meeting: Philadelphia, 1931.

SECTION ON RADIOLOGY, AMERICAN MEDICAL ASSOCIATION
Secretary, Dr. G. W. Grier, Jenkins Arcade, Pittsburgh, Pa.
Annual meeting: Philadelphia, 1931.

RADIOLOGICAL SOCIETY OF NORTH AMERICA
Secretary, Dr. I. S. Trostler, 812 Marshall Field Annex, Chicago, Ill.
Sixteenth annual session: Los Angeles, Calif., Dec. 1–5, 1930.

RADIOLOGICAL SECTION, LOS ANGELES COUNTY MEDICAL SOCIETY
Secretary, Dr. Orville N. Meland, 1407 S. Hope St., Los Angeles.
Meets on the third Wednesday of each month at the California Hospital.

RADIOLOGICAL SECTION, SOUTHERN MEDICAL ASSOCIATION
Secretary, Dr. W. S. Lawrence, Medical Arts Bldg., Memphis, Tenn.

BUFFALO RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. Joseph S. Gian-Franceschi, 610 Niagara St.
Meets second Monday of each month except during the summer months, the place of meeting to be selected by the host.

CHICAGO ROENTGEN SOCIETY
Secretary, Dr. Robert A. Arens, Michael Reese Hospital.
Meets monthly on second Thursday from October to May (except during month of December) at Virginia Hotel. Dinner at 6 P.M., scientific session at 8 P.M.

CLEVELAND RADIOLOGICAL SOCIETY
Secretary, Dr. Harry L. Farmer, 2930 Prospect Ave.
Meetings are held at 6 o'clock at the University Club on the fourth Monday evening of each month from September to April, inclusive.

DETROIT ROENTGEN RAY AND RADIUM SOCIETY
Secretary, Dr. O. J. Shore, Fisher Building,
Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

CENTRAL ILLINOIS RADIOLOGICAL SOCIETY
Secretary. Dr. H. C. Kariher, Decatur, Illinois
Regular meetings held quarterly.

INDIANA ROENTGEN SOCIETY
Secretary, Dr. J. N. Collins, Indianapolis, Ind.
Annual meeting each February 22 in Indianapolis.

MILWAUKEE ROENTGEN RAY SOCIETY
Secretary, Dr. J. E. Habbe, 221 Wisconsin Ave., Milwaukee.
Meets first Friday in October, December, February and April.
Place of meeting designated by the president.

MINNESOTA RADIOLOGICAL SOCIETY
Secretary, Dr. L, G. Rigler, University Hospital, Minneapolis, Minn.

NEW ENGLAND ROENTGEN RAY SOCIETY
Secretary, Dr. Thomas R. Healy, 370 Marlboro St., Boston. Mass,
Meets monthly on third Friday, Boston Medical Library.

NEW YORK ROENTGEN SOCIETY
Secretary, Dr Robert E. Pound, Fifth Avenue Hospital.
Meets monthly on third Monday, New York Academy of Medicine.

CENTRAL NEW YORK ROENTGEN RAY SOCIETY
Secretary, Dr. D. S. Childs, 316 Gurney Bldg., Syracuse, N. Y. Three meetings a year—April, August and November.

PACIFIC COAST ROENTGEN RAY SOCIETY
Secretary, Dr. Harold B. Thompson, Seattle, Wash.
Two meetings a year.

PENNSYLVANIA RADIOLOGICAL SOCIETY
Secretary, Dr W. E. Reiley, Clearfield, Penna.
Two meetings a year, April and October.

* Secretaries of societies not here listed are requested to send the necessary information to the Editor.

PHILADELPHIA ROENTGEN RAY SOCIETY
Secretary Dr. John T. Farrell, Jr., 235 S. 15th St., Philadelphia.
Meets monthly on first Thursday evening, Pennsylvania Hospital.

ROCHESTER ROENTGEN RAY SOCIETY, ROCHESTER, N. Y.
Secretary, Dr. James M. Flynn, 282 Alexander St.
Meets monthly on the first Friday evening at 7:45 at the Rochester Medical Association Building.

ST. LOUIS ROENTGEN CLUB
Secretary-Treasurer, Dr. L. R. Sante, Missouri Building
Meets first week of each month. Time and place of meetings designated by president.

TEXAS RADIOLOGICAL SOCIETY
Secretary-Treasurer, Dr. C. P. Harris, Houston, Texas.
Meets annually one day preceding the meeting of the Texas State Medical Association.

UNIVERSITY OF MICHIGAN ROENTGEN RAY SOCIETY
Secretary, Dr. D. M. Clark, University Hospital, Ann Arbor, Mich.
Meets every Wednesday evening from September to July, at 7:30 o'clock in the amphitheatre of the University Hospital.

VIRGINIA ROENTGEN RAY CLUB
Secretary, Dr. Wright Clarkson, 205 S. Sycamore St., Petersburg, Va.
Next meeting, Norfolk, Va., 1 P.M., Wednesday, Oct. 22, 1930.

CUBA

SOCIEDAD CUBANA DE RADIOLOGIA Y FISIOTERAPIA
Secretary, Dr. Francisco Padron, Enrique Villuendas 64, Havana, Cuba. Meets monthly in Havana.

BRITISH EMPIRE

BRITISH INSTITUTE OF RADIOLOGY INCORPORATED WITH THE RÖNTGEN SOCIETY
Meets on the third Thursday of each month, from November to June inclusive, at 8:15 P.M., at 32 Welbeck St., London, W. 1., or as advertised.

ELECTRO-THERAPEUTIC SECTION OF THE ROYAL SOCIETY OF MEDICINE (CONFINED TO MEDICAL MEMBERS)
Meets on the third Friday of each month during the winter at 8:30 P.M. at the Royal Society of Medicine, 1 Wimpole St., London, W. 1.

SECTION OF RADIOLOGY AND MEDICAL ELECTRICITY, AUSTRALASIAN MEDICAL CONGRESS
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

RADIOLOGICAL SECTION OF THE VICTORIAN BRANCH OF THE BRITISH MEDICAL ASSOCIATION
Secretary, Dr. Colin Macdonald, Lister House, 61 Collins St., Melbourne, Australia.
Meets monthly at Melbourne during the winter.

SECTION ON RADIOLOGY, CANADIAN MEDICAL ASSOCIATION
Secretary, Dr. A. H. Rolph, 160 St. George St., Toronto, Ont.

RADIOLOGICAL SECTION, NEW ZEALAND BRITISH MEDICAL ASSOCIATION
Secretary, Dr. P. C. Fenwick, The Hospital, Christ-church.
Meets annually.

CONTINENTAL EUROPE

BELGIAN SOCIETY OF ROENTGENOLOGY
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium).
Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

SOCIETE DE RADIOLOGIE MÉDICALE DE FRANCE
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

SOCIÉTÉ SUISSE DE RADIOLOGIE (SCHWEIZERISCHE RÖNTGEN-GESELLSCHAFT)
Secretary for French language, Dr. A. Grosjean, La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel.
Meets annually in different cities.

SOCIÉTÉ FRANCAISE D'ELECTROTHÉRAPIE ET DE RADIOLOGIE MÉDICALE
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

ASSOCIATION OF GERMAN ROENTGENOLOGISTS AND RADIOLOGISTS IN CZECHO-SLOVAKIA
Secretary, Dr. Walter Altschul, German University, Prague, II/52.

DEUTSCHE RÖNTGEN-GESELLSCHAFT (GESELLSCHAFT FÜR RONTGENKUNDE UND STRAHLENFORSCHUNG)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aerzte.
Permanent secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

SUD- UND WESTDEUTSCHE RÖNTGENGESELLSCHAFT
Meets annually in different cities.

NORD- UND OSTDEUTSCHE RÖENTGENGESELLSCHAFT
Meets annually in different cities.

DUTCH SOCIETY OF ELECTROLOGY AND ROENTGENOLOGY
Holds two meetings a year in Amsterdam, one in the Spring, and one in the Fall.

SOCIETA ITALIANA RADIOLOGIA MEDICA
Secretary, Professor M. Ponzio, University of Turin, Turin.

SOCIETATEA ROMANA DE RADIOLOGIE SI ELECTROLOGIE
Secretary, Dr. Nicolae Busila, 44 Elizabeta Blvd., Bucarest.
Meets second Monday in every month with the exception of July and August.

ALL-RUSSIAN ROENTGEN RAY ASSOCIATION, LENINGRAD, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson.
Meets annually.

LENINGRAD ROENTGEN RAY SOCIETY
Secretaries, Drs. S. G. Simonson and G. A. Gusterin.
Meets monthly on the first Monday at 8 o'clock in the State Institute of Roentgenology and Radiology, Leningrad.

MOSCOW ROENTGEN RAY SOCIETY
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky.
Meets monthly on the first Monday at 8 o'clock, the place of meeting being selected by the Society.

POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. A. Elektorowicz, 19 Hoza St., Warsaw. Meets annually.

WARSAW SECTION, POLISH SOCIETY OF RADIOLOGY
Secretary, Dr. B. Krynski, 11 Zielna St.
Meets once a month except in the summertime.

SCANDINAVIAN ROENTGEN SOCIETIES
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with the exception of the Denmark Society, meets every second month except in the summertime:

SOCIETY OF MEDICAL RADIOLOGY OF SWEDEN
Meets in Stockholm.

SOCIETY OF MEDICAL RADIOLOGY IN NORWAY
Meets in Oslo.

SOCIETY OF MEDICAL RADIOLOGY IN DENMARK
Secretary, Dr. O. Wissing, Copenhagen.
Meets on the second Wednesday of each month from October to July in Copenhagen, at 8 o'clock in the State Institute of Roentgenology.

SOCIETY OF MEDICAL RADIOLOGY IN FINLAND
Meets in Helsingfors.

VIENNA SOCIETY OF ROENTGENOLOGY
Secretary, Professor Holzknecht, Vienna, IX, General Hospital.
Meets on the first Tuesday of each month from October to July.

VIENNA LETTER

(From Our Special Correspondent)

NEW POSSIBILITIES IN ROENTGEN DIAGNOSIS

Dr. A. Bouwers, Professor of Roentgenology in Eindhoven, Holland, as a guest of the Royal Medical Society of Budapest, discussed the latest achievements in roentgen diagnosis. He emphasized that advancements may be found in the following domains: (1) the quality of the roentgenograms; (2) the lessening of the dangers connected with diagnostic procedures, and (3) the simplification of the apparatus. The improvement in the contrast of the roentgenograms has been brought about by reason of our ability to regulate the quality of the rays; the sharpness of the roentgenograms goes hand in hand with the shortening of the time of exposure. This aim could only be obtained by improvement of the photographic material such as the sensitivity of the films, on the one hand, and on the other, the improvement is in direct proportion to the improvement of the tube in its ability to carry heavier loads. In this respect a great progress has been inaugurated by the roentgen tube with revolving anode, constructed and invented by Professor Bouwers. In this tube the anode is revolved by a special electrical appliance and its purpose is to distribute the heat evenly through the whole cone-like surface of the revolving anode. By this construction we are able to increase the power of the tube at least seven-fold. That means that the time of exposure is lessened considerably and thereby the roentgenogram gains immensely in its sharpness.

In the dangers incident to the use of the tubes we are fairly perfectly protected by the various protective appliances. In Europe the most popular are the Metalix tubes in which, as its name implies, protection is rendered by the metal housing of the tube with a window through which

the rays pass in only one direction. Perfect protection against high tension currents has been achieved in the manufacture of some deep therapy apparatus, while the majority of the installations leave much to be desired from this point of view. In the portable diagnostic sets, safety is assured from high tension currents by special grounding of these currents. Most sets are still too complicated. Up to this time manufacturers have been endeavoring to add mechanical features to their apparatus, while now the constructors' principal aim is reduction in size and a simplification of the apparatus.

RADIATION TREATMENT OF CANCER

Dr. Gösta Forssell, Professor of Roentgenology at the University of Stockholm, and Editor of the well-known journal, *Acta radiologica*, was a guest of the Vienna Austrian Society for Research in the Control of Cancer. He gave an account of his twenty years' experience in the Radium Institute at Stockholm in the radiation treatment of cancer. In this Institute he has been able to prove that radium therapy gives at least the same results as does the surgical treatment in the majority of cancerous growths. His experience has indicated that radium therapy combined with surgical intervention leads to much better results than does one procedure alone. Also that radiotherapy applied prior to the operative interference reduces the size of the tumor and renders the tissues less resistant, while irradiation following operation destroys the remainder of the cancer cells left at the site of operation. Of course the best results are obtained in well-equipped institutes and where the main stress is laid on radiotherapy and not on surgical interference. A radiotherapeutic institute should possess at least 2 grams of radium. It is folly to distribute the radium among several hospitals, the results if added together being inferior to those obtained if the whole is used in one hospital.

INDIRECT ROENTGEN BURNS

In a recent address given by Professor Groedel and Dr. Lossen, Frankfurt a. M., a very exhaustive discussion of the subject of roentgen burns was given. Professor Groedel emphasized the fact that besides technical errors and oversights, the cumulative effects of roentgen rays is not to be underestimated in the pathogenesis and etiology of roentgen burns. To the cumulative effects are often added the harmful effects of mediciments such as adrenalin, arsenic, quinine, iodine, salvarsan, and similar ointments, compresses and plasters, and to these may be added the irritating effects on the skin following roentgen treatment caused by fomentations, hyperemic congestion and the application of ultraviolet, Finsen and sun rays.

THE RAISING OF THE TARIFF ON IMPORTED ROENTGEN APPARATUS IN HUNGARY

According to the Hungarian Ministry of Finance, roentgen apparatus and their accessories will become subject to a huge increase in their import duties, this amounting to 800 per cent in comparison with the present duty. The enactment which is to protect the interests of the Hungarian manufacturers has caused great indignation in medical circles because the new order is apt to handicap the modernization of doctors' offices. To overcome this difficulty a Holland firm, Messrs. Phillips, have offered their apparatus at the prevailing prices, they themselves assuming the increased duty. This gesture was gratefully received by the Hungarian medical profession, particularly at this time when the medical profession is suffering from the general economic and financial depression.

THIRD INTERNATIONAL CONGRESS OF RADIOLOGY

PARIS, JULY 27–31, 1931

The five United States Delegates to the Third International Congress of Radiology met in Detroit on June 23, 1930, to discuss ways and means of apportioning the necessarily limited number of contributions to the scientific program from the United States.

It was decided that all those wishing a place on the program should communicate with the Secretary of the American Committee, Dr. Edwin C. Ernst, Beaumont Medical Building, St. Louis, Mo., not later than October 1, 1930.

The scientific program of this Congress will be divided into six sections as follows:

(1) Roentgen diagnosis
(2) Roentgen and curie therapy
(3) Radiobiology
(4) Radiophysics
(5) Natural and artificial heliotherapy
(6) Medical electrology.

All requests for space on the program must include the full title of the paper, name or names of the authors, together with a brief abstract not to exceed 400 words.

The local committee of five will review the requests and make the necessary recommendations to the International Committee, but in addition, whenever it may be deemed expedient, the opinion of other radiologists and specialists will be invited so that an impartial decision may be reached.

President Antoine Béclère has informed the American Committee that each contribution will be limited to fifteen minutes. Furthermore, should the communications submitted by the respective countries be too numerous, the International Committee in Paris reserves the right to limit their number even though the local committee had accepted such contributions.

The meetings of the Congress will be held at the Sorbonne, which is located within the city limits and is the site of the University of Paris. There will be no special hotels provided for headquarters, and all participants in the Congress are at liberty to select such hotels as may suit their individual needs. It is urged that those anticipating attending the Congress make reservations as early as possible in order to secure good accommodations.

Edwin C. Ernst, *Secretary*
United States Delegation

THIRD INTERNATIONAL CONGRESS OF RADIOLOGY

GENERAL ANNOUNCEMENT

A written announcement of communications intended for the Congress must be sent in before January 1, 1931. A typewritten abstract (in English, French or German) not exceeding 400 words of each paper should reach the offices of the Congress before April 1, 1931. These abstracts will be assembled in a printed volume which will be distributed to members before the opening of the Congress. Each member is entitled to one paper only, the reading of which shall not exceed fifteen minutes.

Should the papers submitted be too numerous for all to be read, the Bureau of the Congress shall have the right to limit the number or shorten the time of presentation.

Members of the various societies of radiology wishing to attend the Congress are requested to fill in and return as soon as possible the accompanying form (see advertising page vii) together with a sum of 300 French francs as membership fee. Those members of the Congress who will be accompanied by members of their family desirous of having a part in the receptions and festivities during the Congress, should state on the form the number of persons and should send a fee of 50 French francs for each individual.

Each member of the radiological societies shall receive this general information together with the subscription form and further information will be forwarded later to all those sending in their subscription to the Congress.

An exhibition will be arranged in connection with the Congress. Persons or firms wishing to take part in the exhibition will obtain all particulars from M. H. Pilon, Commissary General of the exhibition, 34 Boulevard de Vaugirard, Paris, XV^{e}.

Please address all communications and correspondence to the Offices of the Third International Congress of Radiology, 122 Rue La Boetie, Paris, VIII^{e}.

ANTOINE BÉCLÈRE, *President*
R. LEDOUX-LEBARD, *Secretary General*

TREATMENT OF ANGINA PECTORIS

To the Editor:

In my article on "The Treatment of Angina Pectoris by Paravertebral Short Wave Radiation" which appeared in the August, 1930, issue of the American Journal of Roentgenology and Radium Therapy (p. 163), I stated that I could find but two references in the American literature concerning similar treatment. I have since noted in an article (Delherm, L., and Beau, H. La radiothérapie du sympathique dans certaines affections cardio-vasculaires. *J. de radiol. et d'électrol.*, July, 1930, *14*, 391) a reference to an article on this subject by Beall and Jagoda (Roentgenological treatment of neurocirculatory diseases. *South. M. J.*, 1926, *19*, 590–591).

I wish to give credit for this earlier work which I accidentally failed to note and request that you make this acknowledgment in the pages of the Journal.

MARCY L. SUSSMAN

WESTINGHOUSE FORMS X-RAY COMPANY

The Westinghouse Electric and Manufacturing Company has recently announced its entrance into the x-ray field through a newly organized company known as the Westinghouse X-Ray Company, Incorporated. Two x-ray companies already well-known to roentgenologists, the Wappler Electric Company of Long Island City, New York, and the American X-Ray Corporation of Chicago, will be identified with this organization.

The officers of the Westinghouse X-Ray Company, Inc., are: A. E. Allen, President; Calvert Townley, Vice-President; Warren H. Jones, Secretary, and T. J. Illing, Treasurer.

Vol. XXIV, No. 3

DEPARTMENT OF TECHNIQUE

Department Editor: David R. Bowen, M.D., Pennsylvania Hospital, Philadelphia, Pa.

CHOLECYSTOGRAPHY IN THE LEFT LATERO-ANTERIOR POSITION

By I. W. HELD, M.D., *Attending Physician, and* A. ALLEN GOLDBLOOM, M.D., *Adjunct Physician*
Beth Israel Hospital
NEW YORK CITY

VISUALIZATION of the gall-bladder by means of the Graham method has revolutionized the diagnosis of gall-bladder disease. The most accepted and certainly very valuable positions in which gall-bladder films are taken are the posteroanterior position with the patient lying on the abdomen, and the erect position, in order to demonstrate the mobility of the gall-bladder.

Recently Chiray, Lomon and Albot* reported the results of their experimental and clinical work regarding a new position which they have called the left lateroanterior position. They found that when the patient lies on his back the gall-bladder moves up considerably, is under the liver and remains on a line with the lower border of the liver. When the patient is on the abdomen, as is well known, the gall-bladder is generally vertical. If, however, the patient lies in the left lateroanterior position the liver as a whole moves somewhat to the left leaving a clear space between the kidney and the liver shadows so that the gall-bladder shadow appears most distinctly on the film. The gall-bladder is not covered in any of its parts by the liver. Its density is more marked, and in many cases one is enabled to see even the outline of the cystic duct, where otherwise it would not be seen. Because the gall-bladder in the position they advocate comes much nearer the anterior wall these French

* Chiray, M. Lomon, A., and Albot, G. La vesicule biliaire, sa topographie radiologique et clinique, son exploration par le palper abdominal. *Presse méd.*, 1929, *37*, 1437–1440.

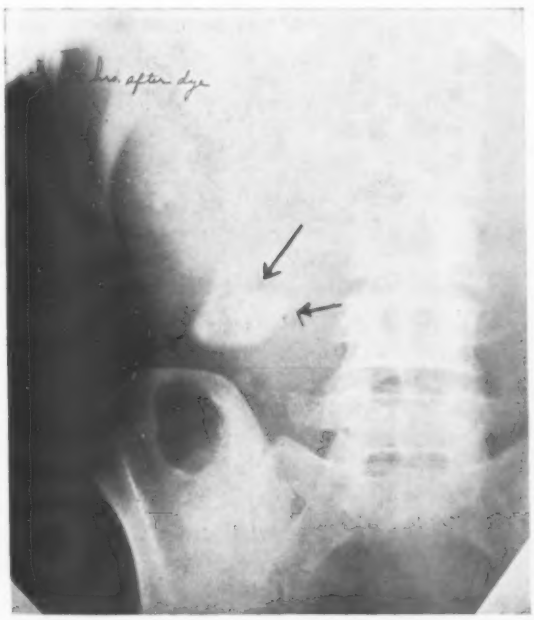

Fig. 1*a*. Film taken in posteroanterior position. Shows gall-bladder filled, appearing as if held by adhesions, and angulated.

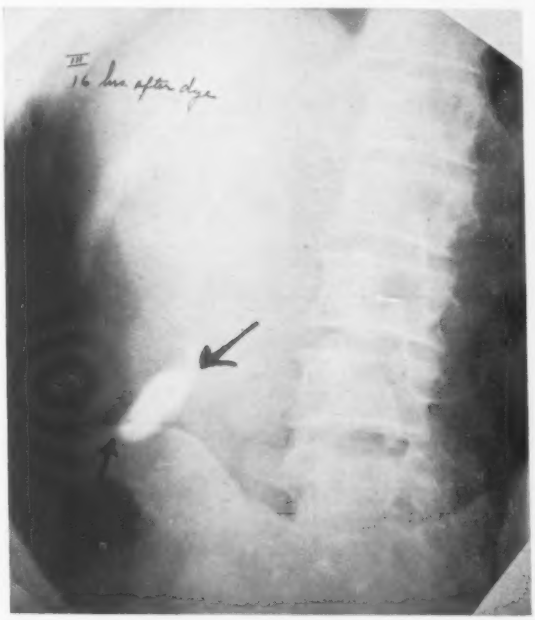

Fig. 1*b*. Film of same patient taken in left lateroanterior position, showing movability of gall-bladder and no deformity.

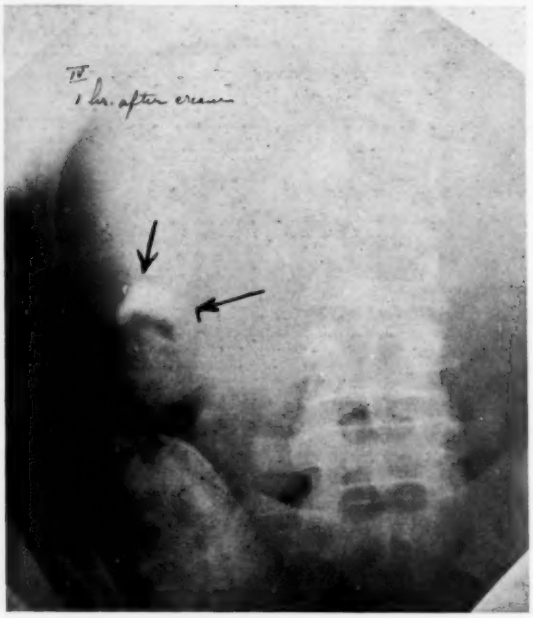

FIG. 1*c*. Shows gall-bladder empty, moved up and deformed by gas in the colon.

authors have even recommended palpation in this position.

Seeing the advantage of this position, we have now routinely adopted it in addition to the established positions. We are finding it so advantageous, adding so much to our diagnostic information, that we think it worthy of report. We believe its clinical application should be encouraged, not so much as a matter of choice but as a method of necessity.

The method as we employ it is as follows:

The patient lies on the left side, the shoulders and hips in a straight line. The patient is then rotated to an angle of approximately 30°. Using the Potter-Bucky diaphragm and a cone, the average exposure is 3 sec., 5 in. spark gap and 25 ma., focused over the spine from the 12th dorsal to the 2d or 3d lumbar region. The focus should be somewhat lower in thin individuals and somewhat higher in those who are stout. However, one always focuses over the spine.

FIG. 2*a*. Posteroanterior roentgenogram, showing gall-bladder well filled.

FIG. 2*b*. Patient in left lateroanterior position, slightly oblique. Film shows gall-bladder beneath the liver and movable.

The advantages of the left lateroanterior position are best exemplified in the accompanying films. Figure 1*a* shows the gall-bladder of an asthenic individual, anteroposterior position. The gall-bladder is angulated, suggesting adhesions. The

Fig. 3*a*. Patient in posteroanterior position, showing filled gall-bladder, but partially overshadowed by the spine, and rounded shadows within the gall-bladder.

Fig. 3*b*. Patient in left lateroanterior position, slightly oblique, showing a more definite outline of the gall-bladder, not hidden by the spine, and the rounded shadows to be stones.

lower border is well above the crest of the ilium. Figure 1*b*, taken immediately after Figure 1*a*, in the left lateroanterior position shows that the gall-bladder has unfolded itself, the lower border being a little below the crest of the ilium. Figure 1*c*, taken one hour after the ingestion of cream, shows that the gall-bladder has moved up well and is slightly deformed by surrounding gas. If films of this gall-bladder had been

Fig. 4*a*. Patient lying on abdomen (posteroanterior position). Filled gall-bladder showing stones, near the spine.

Fig. 4*b*. Patient lying on left side, slightly obliquely. Film shows filled gall-bladder slightly movable, and stones, which moved with gall-bladder.

taken in only one position, namely, in the anteroposterior position, deformity of the gall-bladder due to adhesions would have been diagnosed, as is usually the case with such a deformed gall-bladder.

Figure 2*a* shows the mobility of the gall-bladder in the hypersthenic individual. Although the density of the gall-bladder in this anteroposterior position is somewhat more distinct than in Figure 2*b*, when the film was made in the left lateroanterior position the gall-bladder was seen to have moved much farther toward the right hypochondrium.

In Figure 3*a*, taken in the posteroanterior position, the gall-bladder is almost overshadowed by the transverse process of the spine. Shadows within the gall-bladder—probably stones—are seen. Figure 3*b*, in the left lateroanterior position, shows the gall-bladder outline much more distinctly. We are convinced that the shadows are stones and not due to air bubbles. They actually belong to a gall-bladder that is movable.

Figure 4*a*, in the posteroanterior position, shows shadows within the gall-bladder. These shadows are confirmed in Figure 4*b*, in the left lateroanterior position, the gall-bladder in this film being shown with greater density. It is seen to be a movable gall-bladder.

AUTOMATIC POLARIZER FOR SYNCHRONOUS RECTIFIER

By ROBERT B. TAFT, B.S., M.D.
CHARLESTON, SOUTH CAROLINA

SINCE the introduction of the synchronous rectifier type of machine I have been dissatisfied with the method of determining the polarity by means of the polarity meter and corresponding reversing switches. Difficulty was particularly noticed in setting up a roentgenoscopic machine in the dark and roentgenographic work under difficult circumstances such as for examination of children or uncontrollable adults. In many instances the current was turned backwards into the tube with the resulting dangers.

About eleven years ago I designed and built a simple instrument which automatically polarizes the machine without the attention of the operator as soon as the current is turned on. At that time I was not a physician and applied for a patent on this instrument. The patent, however, was never granted me as it was stated that there was a conflict between my instrument and a British patent of 1892. Undoubtedly this conflict could have been eliminated had I employed skillful lawyers to handle the matter. However, the matter was never followed up and I made no further attempt either to secure a patent or to publish the details until approximately a year ago. Now, believing that this instrument is worthy of consideration by roentgenologists, I have obtained a place on the program of the American Roentgen Ray Society, at the September, 1930, meeting for a paper and a scientific exhibit.

After this place on the program was given me, I found out that a company which manufactures roentgen apparatus has placed on the market an instrument somewhat similar to mine. As I wish to claim priority for this device, I wish to enter as proof a statement from the Commissioner of Patents of the United States Patent Office dated Nov. 3, 1919, acknowledging receipt for "Patent Application for Automatic Polarizer for Synchronous Rectifier." It is not my intention to have any interest in the sale of this instrument.

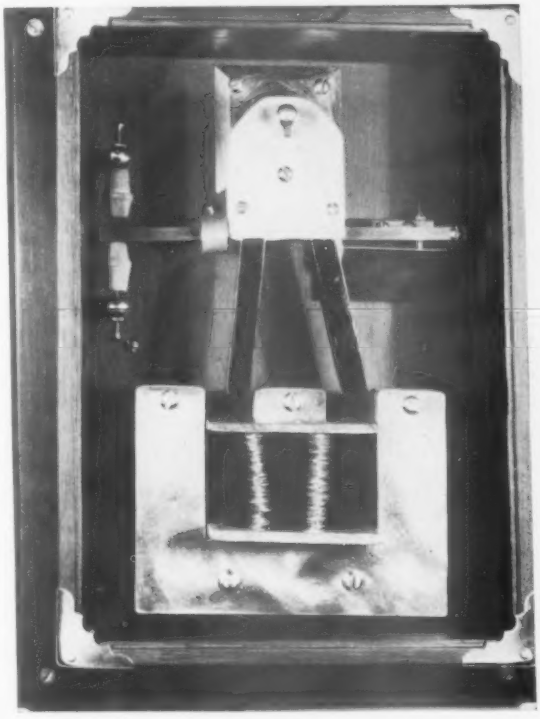

FIG. 1. Photograph of the "automatic polarizer."

As Figures 1 and 2 show, the instrument consists essentially of a permanent horseshoe magnet actuated by an electromagnet which receives its current from the conventional type of rectifying commutator which is found on all of the synchronous rectifier type of machines. The permanent magnet is mounted in such a way that it is allowed to swing freely carrying with it a contact point which is separated from another contact point when the magnet is swung in a given direction. This pair of contacts is connected in series with a syn-

chronous motor. If the rectifier steps in so that the polarity is correct, the contact remains closed, allowing the motor to run undisturbed. If, however, it steps in with

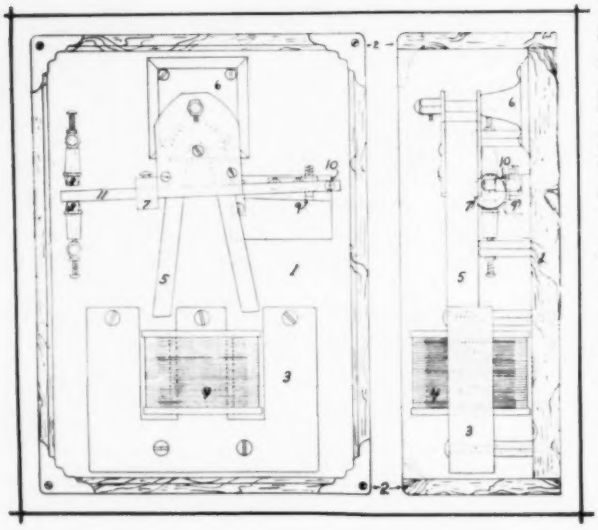

FIG. 2. Drawing of the instrument. 1. Baseboard. 2. Housing cover. 3. Core of electromagnet. 4. Electromagnet. 5. Permanent magnet. 6. Mounting for magnet. 7. Counterweight. 8. Rubber bumpers. 9. Lower contact point. 10. Insulating stud. 11. Square brass rod.

the wrong polarity the electromagnet attracts on one side of the permanent magnet and repels on the other, allowing the motor to slow down until the polarity becomes correct, at which time the magnet swings to a normal position, again closing the contacts and allowing the motor to run on a correct polarity. The above features are shown in the diagram (Fig. 3).

It is to be noted that when the contact points open they disconnect the motor from the mainline but do not cut off the current flowing to the electromagnet through the polarity commutator. This point is of great importance and if it is neglected the apparatus will not function.

The permanent magnet is of the type which was formerly used in the old style Ford magneto, and is suspended vertically from a shaft mounted on the baseboard. To this magnet is bolted a brass rod having on one end a counterweight and on the other end a bakelite stud. The counterweight holds the magnet hanging off center, and just below the bakelite stud is a bronze spring carrying a contact point so arranged that when the magnet swings in the opposite direction from its normal position this contact point is separated from the one above it. The electromagnet is wound on a laminated core made of soft iron sheets 1/64 inch in thickness and bolted together to make a total thickness of 3/4 inch. As is shown in the photograph the core is in the shape of the letter "E" and the winding is placed on the middle leg. The winding consists of a half pound of No. 32 B & S enameled wire. In series with this coil is a variable resistance of about 2500 ohms such as can be purchased from any of the larger radio supply houses. The resistance of this rheostat and the electromagnet together is so great that only about 25 ma. of current is allowed to pass. Even after several hours of continous running the coil does not warm up appreciably.

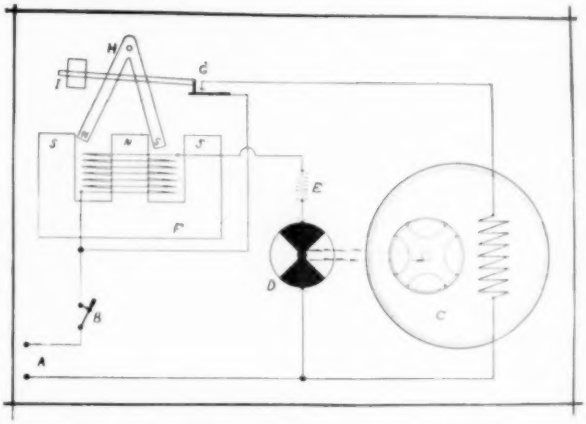

FIG. 3. A. Main line. B. Motor switch. C. Synchronous motor. D. Polarity commutator. E. Resistance unit. F. Core of electromagnet. G. Contact points. H. Permanent magnet. I. Counterweight. S. South poles of magnets. N. North poles of magnets. In this figure, the motor has just stepped off on the wrong polarity. The contacts have opened allowing the motor to slow down. As soon as the polarity becomes correct the magnet will swing to the right, closing the contacts.

The contact points are of a fairly good grade of high-melting point material about 3/16 inch in diameter and can be purchased from any automobile supply house that handles ignition parts. These contact points, if properly aligned, will continuously carry the power to the motor on any diagnostic machine without burning.

The permanent magnet and its mounting are purposely made quite heavy to prevent chattering from the alternating current. In order to prevent the permanent magnet from hitting the laminated core where it might become "frozen", a pair of rubber bumpers are so arranged that the magnet is always kept about 1/16 inch from the core.

All of the parts of the instrument are bolted onto a baseboard of well-seasoned oak about 3/4 inch thick, 10¼ inches long and 7¼ inches wide. A cover of some kind is arranged to keep out dirt. On the instrument of mine the cover is built of oak 3/8 inch thick with a glass panel on the front which allows a view of the operation of the instrument. All of the wiring is connected through the back of the board and two pieces of silk-covered lamp cord are brought out through any convenient opening; the pair going to the contact points should be of one color and those going to the coil should be of another. The instrument must be mounted, absolutely level on a rigid wall.

The resistance unit, which was previously mentioned, is not placed in the instrument housing but is best placed within the control cabinet of the roentgen machine where the ends of the wires are connected.

After the instrument is assembled and the contact points adjusted so that they open just before the magnet reaches the extreme end of its swing, the instrument is ready for mounting on any roentgen machine, the only adjustment necessary being the setting of the rheostat. The rheostat is adjusted so that the very minimum amount of current is delivered to the coil that will cause a swing of the magnet when the current becomes of wrong polarity. After continuous use the magnet will not lose its magnetism, as the flow of magnetism from the electromagnet is such that it will be built up instead of being reduced.

In this description no exact dimensions are given since variations will probably be made by each individual who constructs one to suit the convenience of the materials which he has on hand.

SUMMARY

An instrument is herein described which automatically polarizes the synchronous rectifier type of machine without the attention of the operator.

BOOK REVIEWS

Books Received Are Acknowledged under Heading: Books Received. This must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

LES RAYONS ULTRA-VIOLETS ET INFRA-ROUGES. By W. Vignal, Électro-radiologiste des Hôpitaux de Paris. Paper. Price, 30 Fr. Pp. 239, with 28 illustrations. Paris: Gaston Doin et Cie., 1930.

This little book on ultraviolet and infra-red rays is of precisely the same nature as that on "Electrotherapy" by the same author and which was reviewed in this Journal last year (Volume 21, p. 291). It also is quite suitable for the practitioner; the conservative attitude and pleasing style combined with a most convenient arrangement of the subject matter recommend it to the radiologist interested in light therapy.

The introduction offers a brief historical sketch of the various theories of the nature of light, including the modern quanta theory. This is followed by a detailed discussion of the biophysics of the ultraviolet and infra-red parts of the spectrum with particular consideration of the skin erythema. The present status of the problem of irradiated substances is also sketched. Chapters on the apparatus, dosage of ultraviolet rays and on the general treatment technique precede the therapeutic section where the diseases amenable to light therapy are recorded. Whenever roentgen therapy is indicated in addition to light the dose can be easily identified since potential, tube current, filter, focal skin distance and the dose in French R are given.

A most practical supplement and last chapter relates the "Incidents and Accidents in Light Therapy"; they are subdivided into those due to the apparatus itself and to the therapeutic procedure. In the first group a break of the quartz burner, the dropping of a carbon or ozone poisoning may be considered, while in the second group, injuries to the eyes or systemic reactions, for instance, produced by excessive exposure are mentioned. There is no evidence to date to indicate that late reactions as observed in roentgen therapy appear after exposure to ultraviolet or infra-red rays. A brief bibliography concludes the book.

ERNST A. POHLE

LA SENSITOMÉTRIE CUTANÉE. Introduction a l'actinothérapie rationelle. By J. Saidman, Directeur-Fondateur de l'Institut d'Actinologie. Paper. Price, 60 francs. Pp. 294, with 82 illustrations in the text and four colored plates. Paris: Gaston Doin et Cie. 1930.

The author presents in this monograph, a preliminary report of his investigations dealing with the reaction of the skin to light. He has developed a sensitometer consisting of a metal plate with eighteen holes of different shapes (oval, triangle, rectangle, rhomboid, pentagon) which are concentrically arranged in two circles. In the center, a watch movement provides for the correct exposure of each area for from one to eighteen minutes, by rotating a disk below the openings. Numbers indicate the respective exposure times. The appearance, degree, and course of the reaction can then be studied. A photochemical method based on the color change in paper sensitized by a paraphenylendiamine nitrate solution and compared with a standard serves as a measuring agent for the various sources of light. The skin reactions obtained under various conditions as related to age, complexion, and disease are tabulated and analyzed. Based on the conclusions drawn from these studies, the second part of the monograph brings an outline of the clinical use of light with doses for each mentioned disease, exprsssed in S units. This is a temporary unit for practical use until an International unit has been adopted. A liberal number of illustrations adds much to the understanding of the author's work.

As stated in the preface, this monograph is only a preliminary communication written particularly for the purpose of acquainting other investigators with the method. It is the reviewer's opinion that every radiologist interested in the scientific application of radiation should study the work of Saidman because his method of approach seems to offer many possibilities both in the biologic and clinical phase of light research.

ERNST A. POHLE

Books Received

Tuberculosis Among Children. By J. Arthur Myers, Ph.D., M.D., F.A.C.P., Chief of Medical Staff, Lymanhurst School for Tuberculous Children, Associate Professor of Preventive Medicine, University of Minnesota. Cloth. Pp. 208, with 43 illustrations. Springfield, Ill.: Charles C. Thomas, 1930.

Ergebnisse der Medizinischen Strahlenforschung (Rontgendiagnostik, Rontgen-, Radium- und Lichttherapie). Band IV. Herausgegeben von H. Holfelder, Frankfurt a. M., H. Holthusen, Hamburg, O. Jüngling, Stuttgart, H. Martius, Göttingen, H. R. Schinz, Zürich. Paper, price M. 71; bound, price M. 74. Pp. 694, with 395 illustrations. Leipzig: Georg Thieme, 1930.

Experimental Studies on Roentgen Treatment of Malignant Tumors. (*Acta radiol., Suppl. IX.*) By Jens Juul. Paper. Price, Sw. cr. 8. Pp. 104, with illustrations. Stockholm: P. A. Norstedt & Soner, 1929.

The Effect of Roentgen Irradiation on the Interrelation Between Malignant Tumors and Their Hosts. (*Acta radiol., Suppl. VIII.*) By Carl Krebs. Paper. Price, Sw. cr. 8. Pp. 133, with illustrations. Stockholm: P. A. Norstedt & Soner, 1929.

Étude Clinique et Radiologique des Osteites Condensantes Benignes (Osteites Picnotiques). By Docteur Paul-Marie Bernard, ancien externe des Hopitaux de Paris. (Travail du Service du Professeur Sicard.) Paper. Pp. 119, with 35 illustrations. Paris: Grasse, Impressions "Frago," 1929.

Ultra-Violet Radiations and Their Uses. By Robert Aitken, M.D., F.R.C.P.E., Lecturer on Diseases of the Skin, Edinburgh University; Assistant Physician, Skin Department, and Physician in Charge Dermatological Light Department, Royal Infirmary, Edinburgh, etc. Cloth. Price, 18/6. Pp. 208, with 15 illustrations. Edinburgh: Oliver and Boyd, 1930.

Ultra-Violet Rays in the Treatment and Cure of Disease. By Percy Hall, M.R.C.S. (Eng.), L.R.C.P. (Lond.), Hon. Actino-therapist, the Mount Vernon Hospital, London and Northwood, Hon. Consulting Physician to the Hull Municipal Light Clinic, etc. Fourth edition. Cloth. Price, $4.50. Pp. 248, with 64 illustrations. St. Louis: The C. V. Mosby Co., 1930.

X-Ray Crystallography. By R. W. James, M.A., B.Sc., Senior Lecturer in Physics in the University of Manchester. Cloth. Price, $1.15. Pp. 88, with 29 illustrations. New York: E. P. Dutton & Co., Inc., 1930.

Medical and Surgical Year-Book of the Physicians Hospital of Plattsburgh. Comprising Wednesday Afternoon Invitation Lectures; Papers of the Cardiac Round Table; The First Beaumont Lecture; Collected Papers by the Staff. Cloth. Price, $3.50. Pp. 322, with numerous illustrations. Plattsburgh, N. Y.: The William H. Miner Foundation, 1930.

Merck's Index: An Encyclopedia for the Chemist, Pharmacist and Physician. Fourth edition. Cloth. Price, $5.00 (discount of 50 per cent to members of and those affiliated with the medical, chemical, pharmaceutical and applied professions). Pp. 585. Rahway, N. J.: Merck & Co., Inc., 1930.

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

HEAD

FAY, TEMPLE. Generalized pressure atrophy of the brain secondary to traumatic and pathologic involvement of Pacchionian bodies. *J. Am. M. Ass.*, Jan. 25, 1930, *94*, 245–249.

Cerebral trauma of varying severity is frequently followed by a train of indefinite central nervous system disorders which present no localizing signs. Commonly these phenomena are the result of pressure atrophy of the fronto-parietal region of the cerebrum due to interference with the free absorption of cerebrospinal fluid by the subarachnoid villi and pacchionian bodies which were injured by the red blood cells in the cerebrospinal fluid at the time of injury. The diagnosis is made by encephalography.

In traumatic cases the presence of red blood cells in the cerebrospinal fluid calls for removal by repeated drainage by lumbar puncture from once to three times daily up to the fifth to seventh day.

Acute cerebral trauma cases are treated as follows: (1) By surgery; (a) compound fracture; (b) depressed fracture giving localizing signs; (c) middle meningeal hemorrhage or focal clot. (2) By dehydration or drainage or both. Cases with generalized pressure symptoms without focal signs.

The technique in the latter group is briefly: (1) Treatment for shock. (2) Neurological examination, including palpation of skull. (3) Lumbar puncture to determine presence and character of fluid. Bloody fluid indicates drainage. Pressure is controlled by limited fluid intake and magnesium sulphate by rectum. Equilibrium is maintained in the presence of shock by a carefully adjusted combination of these agents with 50 per cent glucose and physiological sodium chloride and glucose intravenously. (4) Roentgen examination on admission is of least importance except in evidently depressed or compound fractures. Otherwise it should wait until the patient is out of danger. Even in cases of demonstrable fracture by roentgenogram, operation should be based primarily upon neurological signs. (5) Restricted fluid intake is enforced for three months following injury and a limit of 2000 c.c. daily is prescribed for the future.—*G. R. Miller.*

KRABBE, KNUD H., and WISSING, OVE. Calcifications de la piemère du cerveau d'origine angiomateuse démontrée par la radiographie. (Calcifications of the pia mater of the brain of angiomatous origin demonstrated by roentgenography.) *Acta radiol.*, 1929, *10*, 523–532.

Four cases and roentgenograms of the surface of the brain are reproduced. They show a shadow corresponding exactly to the convolutions and fissures of the brain which the author calls a gyriform shadow. Three of the patients, like those previously described in the literature, had vascular naevi, "wine-spots," of the face. The brain shadows are probably caused by calcified angiomas of the pia mater. About 10 similar cases have been described in the literature.—*Audrey G. Morgan.*

NECK AND CHEST

PELISSIER, G. Un cas de méga-oesophage. (A case of mega-esophagus.) *Bull. et mém. Soc. de radiol. méd. de France*, Dec., 1929, *17*, 315–316.

An unusual case of mega-esophagus (in a man sixty-five years of age) is briefly described. The dilatation of the esophagus was so pronounced that it gave the impression of a veritable intrathoracic stomach. In spite of this enormous extent of the lesion the patient had practically no complaint.—*T. Leucutia.*

LAPEYRE. Un cas de diverticule antérieur de l'oesophage. (A case of anterior diverticulum of the esophagus.) *Bull. et mém. Soc. de radiol. méd. de France*, Dec., 1929, *17*, 318–319.

A diverticulum localized to the anterior aspect of the esophagus (at the level of the concavity of the aortic arch) was observed in a man fifty-six years of age. The condition is extremely rare.—*T. Leucutia.*

SURMONT, J., and MAIRE. Cancer de l'oesophage. Fistule pleurale. (Cancer of the esophagus; pleural fistula.) *Bull. et mém.*

Soc. de radiol. méd. de France, Jan., 1930, *18*, 35–36.

A cancer of the esophagus perforated into the pleural cavity, leading to the passage of the barium meal into the right costodiaphragmatic sinus. The patient died within a few hours following the examination and the autopsy revealed a pleural fistula from a primary carcinoma of the esophagus.—*T. Leucutia.*

Naumann, H. Ueber einen Fall von verkalkter Pleuraschwarte. (A case of calcified pleural thickening.) *München. med. Wchnschr.*, Feb., 14, 1930, *77*, 279–280.

A case of calcification of the pleura observed in a man sixty-seven years of age, who three years previously suffered from an acute pleuritis, is briefly described and the roentgenograms in posteroanterior and lateral views reproduced.—*T. Leucutia.*

Jalet. A propos de quelques cas de "lobe accessoire de la veine azygos." (Concerning a few cases of "accessory lobe of the azygos vein.") *Bull. et mém. Soc. de radiol. méd. de France*, Dec., 1929, *17*, 281–285.

Sixteen cases of azygos lobe were observed by the author in a total of 1600 examinations. In 2 cases the condition was detected at roentgenoscopy.

The author proposes the term of "tearshaped" shadow instead of the "comma-shaped" shadow of the Anglo-Americans for the designation of the characteristic roentgen image of the reduplication of the pleura which at one end incloses the vena azygos (appearing in cross section on the roentgenogram).

The reduplication of the pleura may be the seat of collections of pachypleuritis. It is probable that many of the peculiar bands observed in the region of the right upper lobe represent the sequelae of such a pachypleuritis. —*T. Leucutia.*

Jalet, J. La constatation d'un lobe accessoire de la veine azygos, a-t-elle la valeur d'un signe important de pachypleurite? (Does the demonstration of an azygos lobe represent an important sign of pachypleuritis?) *Presse méd.*, May 7, 1930, *38*, 625–627.

On the basis of a study of 16 cases of azygos lobe which were reported previously (see above abstract) the author is of the opinion that the visualization of the reduplicated pleura (mesoazygos) of the azygos lobe does not signify a pathological condition. It is a generally accepted rule that every pleura which is visible on the roentgenogram is pathological, but this does not hold true for the azygos lobe since here, because of the reduplication, there are four pleural layers producing a thickness sufficient to cast a shadow on the roentgen film.

The knowledge of the pleural reduplication of the azygos lobe, however, is important since it may form the site of an encysted collection in localized pachypleuritis (with or without association of parenchymal lesions) and may indicate the extension of the infection in a generalized pleuritis.—*T. Leucutia.*

Bradford, John Rose. Massive collapse of the lung. *Lancet*, Feb. 15, 1930, 1, 331–334.

Massive pulmonary collapse is seen in military and civil practice. Its frequency cannot be stated because it is often overlooked. Two causes probably exist. One is palsy of the respiratory muscles; the other is bronchial obstruction. The physical findings are characteristic of three stages: (1) Weak breath sounds, immobility of chest, high diaphragm and displaced mediastinal viscera. (2) Tubular breathing replaces the weak breathing. (3) Crepitation and rales occur. The symptoms are variable. Dyspnea is the commonest subjective sign, but it is to be stressed that considerable pulmonary involvement may result in but slight dyspnea. The involvement is usually basal, rarely bilateral. Physical signs change rapidly as does the underlying condition. There may be inflammatory complications.

The mechanism of production probably is a reflex splinting of the muscles of respiration with a consequent rapid absorption of intrapulmonary air and the formation of bronchial obstruction by mucus and exudate.—*G. R. Miller.*

Pinchin, A. J. S., and Marlock, H. V. Atelectatic bronchiectasis. *Brit. M. J.*, Jan. 4, 1930, *1*, 12–13.

In roentgenograms of the chest a triangular density with one side along the mediastinum, the other on the diaphragm, and the hypotenuse extending from mediastinum to diaphragm, may be due to mediastinal effusion or to atelectasis. This area is one of little respiratory movement and favors residual ate-

lectasis. Within the atelectatic area bronchiectasis may frequently be demonstrated by lipiodol injection. Tuberculous mediastinal effusion was responsible for the triangular shadow in one case and atelectatic bronchiectasis in 4 cases.—*G. R. Miller.*

ZORZOLI, P. La questione delle cosidette peribronchiti tubercolari. (So-called tuberculous peribronchitis.) *Radiol. med.*, Feb., 1930, *17*, 166–185.

The pulmonary striation described by Sturz has heretofore been considered, and by some still is, as a sign of peribronchial lymphangitis and an early symptom of beginning tuberculosis. But some authors say that these stripes do not have any pathognomonic value and are only the pictures of the pulmonary vessels. The author from his study of the subject concludes that the stripes may be either the picture of the vessels or a sign of peribronchial tuberculosis. But the vessel stripes have special characteristics by which they may be recognized. In peribronchial tuberculosis, pathological anatomy and clinical roentgen examination both show signs of productive processes in the walls of the bronchi which make it possible to differentiate these pictures from the vessel stripes. The author also finds that the peribronchial stripes are seen not only in beginning infiltration but also in the late and even the terminal stages of pulmonary tuberculosis.—*Audrey G. Morgan.*

ABDOMEN

RADT, PAUL. Eine Methode zur röntgenologischen Kontrastdarstellung von Milz und Leber. (A method for roentgen contrast visualization of the spleen and liver.) *Klin. Wchnschr.*, Nov. 12, 1929, *8*, 2128–2129.

Three c.c. of tordiol (thorium dioxide sol) was injected intravenously into rabbits of 2500 to 3000 gm. weight (0.2 to 0.25 gm. thorium dioxide per kilogram body weight) and in all instances the liver and spleen were well visualized roentgenologically. The method as first used was very toxic and led to numerous cases of paresis with subsequent death. Later, however, a procedure was worked out by which the animals could support the injection without disturbance.

The method is not applicable to humans as yet. Further experiments are in course.—*T. Leucutia.*

SEMENZA, CARLO. Le fistole digiuno-coliche. (Jejuno-colic fistula.) *Radiol. med.*, Feb., 1930, *17*, 125–139.

The literature on the subject of jejuno-colic fistula is reviewed. Most of these fistulas are secondary to peptic ulcer of the jejunum following gastroenterostomy; some of them are caused by tumor. The most important clinical symptoms are emaciation, dysentery, fecaloid vomiting and pain. The author describes a case in a young man of twenty-one in which the clinical symptoms were not sufficient for diagnosis which had to be made from the roentgen examination. The stomach was normal and its motor function active. The contrast medium passed normally through the duodenum and the first loop of the jejunum but in the left upper quadrant there was a large shapeless spot which seemed to envelop two or three segments of intestine; this was at the same site as a resistance that had been palpated clinically and both the spot and the resistance were movable; almost at the same time there was filling of the middle and proximal thirds of the transverse colon and of the distal half of the descending colon. In two hours and a half the stomach was empty; there was still barium in the proximal loops of the jejunum to the abnormal spot; all the rest of the barium was in the large intestine and there was none in the ileum. In the middle of the transverse colon there was a cord-like constriction; this constriction was to the median side of the abnormal spot and in contact with the mass that could be felt clinically. An opaque enema confirmed these signs of jejuno-colic fistula. Operation showed a lymphosarcoma that involved the transverse colon and a loop of the jejunum. The patient recovered and was dismissed well on July 16. He was well for a few months but there was recurrence in the retroperitoneal glands and he died on Dec. 12.

Roentgen examination is invaluable in these cases as it shows passage of the opaque medium from the stomach into the colon and of an opaque enema into the stomach. It is particularly valuable as it is the only means of making an early diagnosis before the patient is reduced to such a condition of cachexia that he cannot bear operation.—*Audrey G. Morgan.*

Fuller, C. J. Cholecysto-colic fistula with unusual radiographic findings. *Brit. M. J.*, Feb. 15, 1930, *1*, 279–280.

A woman aged sixty-nine had had right upper abdominal pain and a smooth tumor six years previously. Gastrointestinal roentgenograms were negative. A diagnosis of cholecystitis with a Riedel's lobe was made. Recently, following severe griping pains in the abdomen, a barium meal and a barium enema showed communication between duodenum, colon, and biliary passages, including the intrahepatic bile ducts. The right upper quadrant tumor was absent. On neither occasion had jaundice been present. There are three possible explanations: (1) one large stone passed into the duodenum and then ulcerated into the colon; (2) one of two stones ulcerated into the duodenum at the first attack, and the other into the colon at the second; (3) a stone ulcerated from the biliary passages into the colon, damaging the subjacent duodenum in its passage. The last is probably correct, the stone having ulcerated through the neck of the gall-bladder. The free communication between colon and intrahepatic bile ducts caused no evident ill effect.—*G. R. Miller.*

Pflaumer. Cholezystographie und urologische Diagnostik. (Cholecystographic and urologic diagnosis.) *München. med. Wchnschr.*, Feb. 7, 1930, *77*, 236–239.

It is advised that in case of severe pain in the right upper abdomen the urologic examination (ureteral catheterization, pyelo-ureterography and pyelo-ureteroscopy) be preceded by a roentgen examination of the gall-bladder. A flat film as a rule helps to demonstrate at least 40 per cent of the gallstones, while cholecystography by means of a contrast medium adds 30 per cent more. The procedure is recommended especially in floating kidneys, doubtful enlargements of the kidney pelvis, ureteral kinkings and in stenosis.

By following this method, many unnecessary operations may be avoided.

The article is illustrated with 11 beautiful roentgenograms.—*T. Leucutia.*

Garcin. La cholecystographie. Les conclusions d'une statistique de 506 cas. (Cholecystography; conclusions from a statistical study of 506 cases.) *Bull. et mém. Soc. de radiol. méd. de France*, Dec., 1929, *17*, 336–338.

Of 506 cases examined by the oral method of cholecystography, in 422 there was visualization of the gall-bladder, in 26 the gall-bladder was invisible but there was evidence of stones and in 58 the gall-bladder remained invisible. Positive information was gained in 88 per cent of the cases.—*T. Leucutia.*

Sandstrom, Carl. Contribution to the roentgenological appearance in cases of benign diverticular growths of the stomach. *Acta radiol.*, 1929, *10*, 427–436.

The author describes a case interesting from the point of view of differential diagnosis, in which roentgen examination of the stomach showed a narrowing of the lumen of the pylorus, which was of the nature of a defect and in the center of which there was a niche-like opaque spot. From the roentgen picture a tentative diagnosis was made of ulcer surrounded by infiltration. Operation showed a benign tumor-like hyperplasia of the pyloric glands in the submucosa and muscularis, surrounding a central diverticulum, that is, a diverticular adenoma, or as a more correct term, on account of the character of the glands: adenomatosis combined with diverticulum.

Such benign diverticular tumors (diverticular myomata or adenomata) are very rare and only one case has previously been described in the literature in which roentgen examination was made. In that case, as in this one, the roentgen findings were incorrectly interpreted. On account of the presence of both diverticulum and tumor in these cases it is difficult to make a roentgen diagnosis. The picture is that of a niche-like opaque spot surrounded by a defect in the contrast shadow, a picture that is typical of ulcer surrounded by infiltration (callous or cancerous). In cases in which ulcer or cancer is suspected for clinical reasons, it is almost impossible to exclude ulcer. To make a correct diagnosis a series of examinations must be made for some time, possibly after an ulcer treatment, after which the changes should remain stationary. In these cases the absence of spasm is an argument against ulcer, another being absence of blood in the feces.—*Audrey G. Morgan.*

Dillenseger. Trois cas de diverticules dits congénitaux du duodénum. (Three cases of

so-called congenital diverticula of the duodenum.) *Bull. et mém. Soc. de radiol. méd. de France*, Jan., 1930, *18*, 28–32.

In connection with 3 cases of diverticula of the duodenum, which are briefly described (one case with complicating ulcer of the bulb), the author expresses the opinion that duodenal diverticula are most probably the result of congenital predisposition. Lesions or functional disturbance of the neighboring organs lead to their development.—*T. Leucutia.*

TESCHENDORF, WERNER. Ueber die Bewertung der Röntgenzeichen des Zwolffingerdarmgeschwurs. (On the usefulness of roentgen signs in duodenal ulcer.) *Klin. Wchnschr.*, Feb. 22, 1930, *9*, 359–365.

On the basis of a series of 572 cases of duodenal ulcer, 68 of which came to operation, the author expresses the following opinion concerning the practical value of the various roentgen signs. The most important and reliable sign is the duodenal niche which occurred in 260 of the cases examined. The niches of the so-called *en face* ulcers, which are localized to the anterior or posterior walls of the duodenum, are often evidenced only by special procedures. The pocket or diverticular formations, the deformities of the duodenal bulb (megabulbus, phthisis bulbi), the normal appearance of the duodenal bulb with five hour gastric residue (due to thickened pyloric ring) and the demonstration of periduodenal adhesions are often of great value in substantiating the roentgen diagnosis of a duodenal ulcer, yet according to the author's estimation operative indications should not be established purely on roentgen findings. In this respect, though it is admitted that the roentgen procedure leads to the detection of many complications and establishes anatomic criteria in the most precise way, the clinical findings are of greater aid.—*T. Leucutia.*

LEDOUX-LEBARD, JAHIEL, and CALDERON, GARCIA. Observation de diverticules multiples du colon. (Observation on multiple diverticula of the colon.) *Bull. et mém. Soc. de radiol. méd. de France*, Jan., 1930, *18*, 27–28.

The authors present an additional case of multiple diverticula of the colon which in spite of repeated roentgen examinations remained long undiagnosed. The authors administered three consecutive opaque meals, 18, 13 and 9 hours previous to the examination, and took films at 9, 24, 36 and 60 hours following the last meal. The films which show a very clear outline of the diverticula are reproduced.—*T. Leucutia.*

LAURELL, HUGO. Ueber die Röntgenuntersuchung von Bruchen, insbesondere klinisch schwer zu diagnostizierenden Formen. (Roentgen examination of hernias, particularly forms that are hard to diagnose clinically.) *Acta radiol.*, 1929, *10*, 462–498.

When roentgen examination has been made in hernia heretofore it has generally been for information in regard to the contents of the sac. The contrast meal, enema and cystography have been used. Roentgen examination is also useful in studying the morphology of the hernial sac and ring. In cases of hernia that can be diagnosed clinically roentgen examination is of no practical value except in examining a clinically doubtful condition of ileus in which strangulation is suspected. Two cases of the latter kind are described: one a femoral hernia, the other an obturator hernia, both being Richter's hernias. The examination in such cases is usually made without any contrast medium. Sometimes, however, when there are no gas bubbles in the small intestine, a few spoonfuls of contrast meal will serve to locate any partial obstruction in the small intestine.

But roentgen examination is of great value in proving the existence of clinically doubtful or non-demonstrable, non-strangulated internal or external hernia. In such cases the contrast meal, or more rarely an enema, is used. The hernial regions are examined from two to seven hours after the contrast meal; loops or smaller parts of intestine projecting from the normal intestinal area and suspected of lying in a hernial sac are more definitely located under the fluoroscope. Examination is then made to see whether under increased intra-abdominal pressure they penetrate farther into the suspected opening. If that is the case the diagnosis of hernia is clear. The roentgen picture of a small hernia at the inguinal region may not be sufficiently characteristic to make the determination of its exact nature immediately possible; in such cases palpation under the fluoroscope must be used. An indirect inguinal hernia and an obturator hernia will give a typical picture

in the early stages. Illustrative cases are described.

Incomplete external hernia is of course often seen as a precursor to complete hernia. The symptoms may be so vague as to make the diagnosis uncertain. The diagnostic value of roentgen examination in cases of that kind is illustrated, for instance, by an unusual case of properitoneal hernia, which had been seen roentgenologically but wrongly interpreted as an inguinal hernia or the beginning of one; and also by a case of incomplete indirect inguinal hernia with pronounced chronic obstruction of the small intestine. The hernia could not be demonstrated clinically in either case. The last-mentioned one proved on operation to be a reducible hernia but with slight adhesions around the loop of intestine. It is possible that these adhesions were the result of an earlier strangulation that had been reduced spontaneously. A chronic appendicitis with adhesions in the immediate neighborhood may also probably result from repeated strangulation. Therefore in any case of operation for suspected appendicitis the hernial regions near the appendix should be examined from the abdomen; if the examination shows an open hernial ring it should if possible be closed when the appendectomy is performed. In doubtful abdominal cases the roentgenologist should always remember to examine the hernial region when giving a contrast meal. Whether the hernia is large or small, free or irreducible, the passage through the small intestine will often be retarded, though generally only slightly. A small residue in the lower ileum after nine hours and a slight liquid level in the small intestine are often seen. In case of strangulation and other complications the passage is of course still more difficult, or even completely obstructed. If the transverse colon lies in the inguinal hernia the stomach may be pulled out lengthwise; if the stomach itself has become involved in the hernia narrowing of the hernial ring may give it an hour-glass shape.—*Audrey G. Morgan.*

GYNECOLOGY AND OBSTETRICS

Jianu, St. I. Câteva date asupra uterosalpingografiei. (Some data on uterosalpingography.) *Cluj. med.*, Feb., 1930, *11*, 74–78.

Uterosalpingography has been used routinely at the surgical clinic of the University of Cluj since 1926. After a description of the technique of injection, which in general corresponds to that used by Cotte, the author briefly describes 8 cases, some of them with unusual findings, in order to prove the value of the method. The conclusion is reached that the method is entirely harmless. It is indicated in malformations, tubal lesions, especially tubal obstruction and as a control procedure of certain operations such as salpingostomy, tubal uterine implantation and myohysteropexy (according to Iacobovici).—*T. Leucutia.*

Surmont, Jean. Lipiododiagnostic d'une tumeur de l'utérus. (Lipiodol diagnosis of a tumor of the uterus.) *Bull. et mém. Soc. de radiol. méd. de France*, Jan., 1930, *18*, 33–34.

The injection of the uterine cavity with lipiodol led to the correct diagnosis of fibroma of the uterus in a woman forty years of age. There was only slight distortion of the uterine cavity but the lead wire method permitted the detection of a lateral displacement. There was also elongation of one of the tubes.—*T. Leucutia.*

GENITOURINARY SYSTEM

Knutsson, Folke. On the technique of urethrography. *Acta radiol.*, 1929, *10*, 437–441.

After having briefly reviewed the method used in urethrography, the author describes a penis clamp made for that particular purpose. The clamp makes the examination simpler and more convenient. He also discusses the so-called supra-collicular elongation of the posterior urethra. In contradiction with Dressler, the author holds that only the 1–2 cm. of the shadow above the colliculis seminalis is caused by the urethra and that the remaining part of it is caused by some of the opaque fluid collecting in a fold of mucous membrane at the bottom of the bladder. The elongation of the urethra is thus as a rule only apparent and no importance can be ascribed to it in estimating the size of the prostate gland. The paper is illustrated by a few urethrograms.—*Audrey G. Morgan.*

Pollack, Herbert. Ein neues Hilfsmittel zur Beseitigung des störenden Meteorismus in der Nierenrontgenographie. (A new adjuvant for the elimination of the dis-

turbing meteorism in kidney roentgenography.) *Klin. Wchnschr.*, Jan. 11, 1930, *9*, 69–71.

The author suggests the use of "enzypan" for the elimination of gas preparatory to roentgen examination of the urinary tract. This preparation contains various enzymes necessary for the stimulation of the digestion in the gastric and intestinal tracts. It is made in the from of a dragé, the outer layer of which contains the gastric ferments consisting of a mass soluble in acid, while the inner layer, which contains the intestinal pancreatic ferments, consists of a substance which is soluble in the alkaline juices. Two to three tablets are taken three times daily following each meal for a period of three days. The evening of the third day a cathartic and the morning of the fourth day three enzypan tablets (on an empty stomach) are taken. Half an hour previous to the examination an enema is given. The method which was used in about 40 cases led to satisfactory results in two-thirds of the cases, while in one-third it was of no value.—*T. Leucutia.*

ARNTZEN, LEIF, and WORNING, BORGE. A case of double renal pelvis and double ureter in both sides. *Acta radiol.*, 1929, *10*, 499–501.

A case is described and illustrated with roentgenograms. The patient was a woman aged forty-eight, who was taken ill six weeks before she came to the hospital with pain in the right kidney region.

Temperature, 38°; no dysuria, no hematuria. Right kidney enlarged, containing albumin and pus. Roentgen examination showed a deep shadow inside the right kidney shadow at the level of the 3d and 4th lumbar vertebrae. Its forms was exactly that of the renal pelvis and calyces. When seen in lateral projection it lay in the same frontal plane as the spinal column; in oblique projection its place in the kidney shadow remained unchanged. It was without doubt a calculus completely moulded to the pelvic cavity and calyces. Both kidney shadows, particularly the right one, seemed extraordinarily long; the concrement-filled pelvis lay below the middle of the right kidney shadow. A second examination was therefore made with an opaque ureteral catheter. Cystoscopy showed the mucous membrane of the bladder normal. On injection of indigocarmin two ureteral orifices were found on each side, the anterior one 0.5 cm. nearer the midline than the posterior one. They were all easily catheterized for their full length and the urine drained from both those on the left side and the anterior one on the right side. The urine from the left side was normal; that from the right contained albumin, leucocytes and gram-positive cocci. As the distance between the two pelves on this side was only about 2 cm. heminephrectomy was out of the question. Nephrectomy was therefore performed. Recovery was uneventful.

Cases of double pelvis and ureter on one side are by no means rare but this anomaly on both sides is unusual. When there are two ureters on the same side the one from the upper pelvis generally opens into the bladder anteriorly and medially from the one belonging to the lower pelvis.—*Audrey G. Morgan.*

JUDD, E. STARR, and GRIER, JAMES P. Multiple malignant adenomas of the kidney. *Arch. Surg.*, Feb., 1930, *20*, 240–245.

A case which came to operation is reported. The patient had a large mass in the left side of the abdomen. A pyelogram showed signs of compression of the lower half of the pelvis, with upward and inward displacement. Renal function was normal on both sides. A total nephrectomy was done. The adenomas were multiple, varying from 0.5 to 12 cm. in diameter. These tumors are mildly malignant but have not been seen to metastasize.—*P. A. Bishop.*

SKELETAL SYSTEM

CASATI, A. Come va interpretato il radiogramma di un affezione ossea? (Interpretation of the roentgenogram in bone diseases.) *Radiol. med.*, Jan., 1930, *17*, 49–56.

The author makes a distinction between the primary essential symptoms of a bone disease and the secondary concomitant symptoms. For instance in a tuberculous bone there is a tuberculous sequestrum or a focus of granulation, shown in the roentgenogram by rarefaction. This is a characteristic of the disease itself. But later other changes appear, such as atrophy or a layer of sclerotic bone. These are not symptoms of the tuberculosis in itself but are signs of reaction in the surrounding bone which may eventually produce sequestra that are not specifically tuberculous.

This reactive capacity on the part of the bone has a great deal to do with the roentgen picture and explains why the roentgen pictures are often so different in the same disease. There are various factors that affect the reactive capacity, such as age, function, duration of the disease, tendency to chronicity, etc. The roentgen picture of a given disease, such as tuberculosis or rickets, will be different in a young person and an old one, a bone that is functioning or one that is not functioning and in a bone in which the course of the disease is rapid or chronic, that is, depending on the virulence of the virus. This makes it extremely difficult to describe the bone picture of any disease in the roentgenogram. The author then gives an interpretation of the symptoms in some bone diseases in accordance with these facts. For instance in osteomyelitis there is sclerosis in young subjects, indicating a reaction of the part of normal tissue. In old patients there is no sclerosis because there is little capacity for apposition. The sclerosis is greater in the cortex than in the center of the bone because the capacity for proliferation is greater there. The longer the duration of the disease, the greater the sclerosis. Independently of age, localization and duration of the disease, there may be no sclerosis in poor conditions of nutrition, for example, in osteomyelitis after severe typhoid followed by cachexia. —*Audrey G. Morgan.*

Rogers, Herbert. A case of solitary plasma-celled myeloma. *Brit. J. Surg.*, Jan., 1930, *17*, 518–522.

Rogers reports a case of myeloma of the plasma-celled type showing only one solitary focus of new growth. Multiple myeloma of the plasma-celled type is of comparatively common occurrence, but cases showing a solitary focus of growth are rare. The patient was admitted to the hospital for a fusiform swelling of the front and inner aspects of the right thigh. The swelling was firmly attached to the bone and showed a semi-solid consistency. No egg-shell crackling could be elicited. The roentgen examination showed a honeycombed appearance in a mass of callus uniting an old fracture, and a rarefaction of the bone extending a short distance above and below the site of injury. There was a history of fracture of the right femur eight months previous to admission. After three operations at several months' intervals, consisting of attempts to shell out the tumor mass, amputation was finally performed. Each operation had been followed by a recurrence of the growth. The pathological examination of the tissue removed at the operations showed a plasma-celled myeloma.

Rogers states that solitary plasma-celled myeloma is a new growth which arises in the bone marrow, and appears to occur more frequently in the long bones than in flat bones or vertebrae. The origin of the tumor is still a matter of dispute; the type cell is believed to be derived either from a lymphocytic cell or from the perivascular endothelium. Ewing's tumor may be mistaken sometimes for myeloma when sections are overstained with hematoxylin. Plasma cells may be found in Ewing's tumor which also makes the diagnosis more difficult.

This patient received radium before the first and second operations. It seems probable that the use of radium, as observed in this case, in large doses, may bring about a condition of radium necrosis, which not only prevents any attempt at recurrence on the part of the tumor tissue but also places the natural reparative reactions in obeyance. The possibility of such an eventuality must be kept well in mind when radium is employed, as the clinical evidence of the necrotic influence may be delayed for ten days or a fortnight.—*R. S. Bromer.*

Junghagen, Sven. Spondylitis deformans mit medullaren symptomen. (Spondylitis deformans with cord symptoms.) *Acta radiol.*, 1929, *10*, 535–538.

A case is described in a man of sixty-six who for six months had had paresthesias in the shape of a feeling that his legs had gone to sleep and had had difficulty in walking. Examination showed no signs of brain disease but there were several symptoms, including a positive Babinski, which indicated disease of the spinal cord and the lumbar roots. The clinical picture, the lack of other symptoms, the absence of a Wassermann reaction and the roentgen findings in the spinal column and subarachnoid space indicate decidedly that this condition was caused by the intense spondylitis deformans from which the patient suffered. Other cases of spondylitis with neurological symptoms have been described, but they were all of the root type, with root pain

and atrophic pareses, caused by periosteal deposits which extended over the intervertebral foramina and more or less occluded them. In this case, too, there were root symptoms but the decreased pain and temperature sensation on the outer side of the spinal column and the other cord symptoms mentioned above could not be explained in this way. They were probably caused by the inelastic intervertebral discs being pushed into the vertebral canal and forming large cartilaginous exostoses there. There were periosteal deposits on the posterior outlines of the bodies of the vertebrae but they were not large enough to have caused the great changes in the myelogram. The exostoses formed incisures in the subarchnoid space and cord. The picture of spondylitis deformans differs greatly from the normal picture for while in the latter there are traces of incisures in the opaque column they are at the middle of the vertebrae between the intervertebral discs, while in spondylitis deformans they are at the site of the intervertebral discs. The exostoses may become large enough to occlude the ventral part of the subarachnoid space and simulate tumor. But the multiplicity of the changes and their position with reference to the intervertebral discs make differentiation possible.—*Audrey G. Morgan.*

DOUARRE. Sur deux cas de maladie de Recklinghausen. (Two cases of Recklinghausen's disease.) *Bull. et mém. Soc. de radiol. méd. de France*, Dec., 1929, *17*, 338.

The two cases are briefly described. The interesting feature is that at the first examination the disease was localized to only one bone. Only later after extension of the disease to other parts of the skeleton could an accurate diagnosis be made.—*T. Leucutia.*

FAIRBANK, H. A. T. Congenital dislocation of the hip; with special reference to the anatomy. *Brit. J. Surg.*, Jan., 1930, *17*, 380–416.

This paper is profusely illustrated with anatomical specimens and roentgenograms and is of special interest to the orthopedic surgeon. The author's summary is as follows:

"In this paper I have endeavoured to call attention to the chief points of interest and importance in the anatomy of congenital dislocation of the hip. In particular the changes in the bone behind the acetabulum, with the occasional formation of a facet at this spot, the arrangement of the capsule and the importance of the ischio-capsular band which forms a sling over the neck of the femur, have been pointed out. The muscles which chiefly assist the capsule in slinging the pelvis on the femur are, I contend, the psoas in front and the obturators and their associates behind. Factors which may contribute towards the production of the characteristic gait, and the causation of the pain experienced in later life, are discussed. Finally, in a rapid survey of the treatment, the various operative procedures at our disposal have been criticized in the light of the foregoing facts and theories.

"In these days of Child Welfare Centres, better diagnosis, and the ever increasing practice of routine X-ray examinations, the number of cases of congenital dislocation left untreated till all hope of a cure is past is gradually diminishing. It cannot be insisted upon too strongly or too often that these cases must be sent to the surgeon early. Treated in early childhood the majority are cured by the manipulative method and of the rest an ever increasing number should be cured by open operation.

"Is it too much to hope that the time will come, and that before many years, when every uncomplicated congenital hip will be cured at an early age, and the difficult problem presented by the irreducible case, hopelessly crippled on reaching adult life, will cease to trouble the surgeon?"—*R. S. Bromer.*

PASCHETTA, VINCENT. Diagnostic de l'engrènement des fractures du col du fémur par la méthode des radiographies en trois positions. (Diagnosis of impaction of fractures of the neck of the femur by means of roentgenograms in three positions.) *Bull. et mém. Soc. de radiol. méd. de France*, Dec., 1929, *17*, 319–325.

The author advises the taking of three roentgenograms for the diagnosis of impacted fractures of the femoral neck: one with the lower extremity straight, one in adduction and one in abduction. In impaction the relation of the head of the femur and of the shaft on the three roentgenograms remains the same, while in case of non-impaction the relation changes. The procedure can also be used with advantage for the estimation of the formation of callus and in pseudoarthrosis.

The method was applied in 20 instances, in 10 of which there was impaction and in 10 non-impaction of the fracture.—*T. Leucutia.*

Renander, Axel. Anomalies roentgenologically observed of the cranio-vertebral region. *Acta radiol.*, 1929, *10*, 502–513.

The author describes a case, examined roentgenologically, of posterior spina bifida of the atlas and an anomaly of the craniovertebral region; in the course of anatomical preparation of the latter specimen it was found that there was a ligamentous connection between the left arch of the atlas and the occiput. The author assumes that, like spina bifida of the lumbosacral region, spina bifida of the atlas may cause spinal cord symptoms. In one case there was also a neurinoma of the auditory nerve; the author thinks this is an interesting analogy with the combination of lumbosacral spina bifida and Recklinghausen's disease.—*Audrey G. Morgan.*

Renander, Axel. Entwicklungsstorungen der Wirbel. Somatoschisis. Hemispondylus. (Disturbances of development of the spinal column. Somatoschisis. Hemispondylus.) *Acta radiol.*, 1929, *10*, 588–597.

Two cases are described, one in man of thirty-seven and the other in a boy of twelve. The anomalies in both cases were discovered on examination for other conditions. In the first, there was a fissure of the bodies of the affected vertebrae and in the other, only half of the vertebrae had developed. In the second case there was also a supernumerary vertebra with an accessory rib. The author classifies these anomalies according to Putti's scheme for disturbances of development of the spinal column, diagrammatic sketches of which are given. There is a disturbance which occurs in the membranous stage of development of the spinal column with an abnormal anlage of the center of ossification; in the second case the center was shifted to one-half of the metamere.—*Audrey G. Morgan.*

Smith, S. Watson. Kümmell's disease. *Brit. M. J.*, Jan. 18, 1930, *1*, 109–110.

Kümmell described a condition of the spine best named a rarefying osteitis of a vertebral body following trauma. There occurs a vertical collapse of the body with posteroanterior wedging. Commonly the acute traumatic symptoms subside rapidly, there follows a latent period of several months or years, and eventually symptoms referable to the consequent deformity appear. Diagnosis depends upon history, local pain and deformity and the roentgen appearances.

A case report is given of a woman of forty-seven, who developed symptoms eleven years after an injury to the cervical spine. The diagnosis of Kümmell's disease was made after careful study.—*G. R. Miller.*

Roederer, C., and Charlier. Un cas rare d'anomalie du sacrum. (A rare case of anomaly of the sacrum.) *Bull. et mém. Soc. de radiol. méd. de France*, Dec., 1929, *17*, 290.

A dermoid cyst of the sacral region in a girl nineteen years of age led to a considerable shortening of the sacrum in the posteroanterior view and a rectangular deformity in the lateral view. The bone destruction produced by the cyst and the pull of the neighboring muscles on the lower end of the sacrum were responsible for the deformity.—*T. Leucutia.*

ROENTGEN AND RADIUM THERAPY

Stumpke, G. Über die Ergebnisse der Röntgentherapie beim Hautkrebs. (Results of roentgen treatment in skin cancer.) *Strahlentherapie*, Jan. 9, 1930, *35*, 98–102.

The author reports the results of the skin cancers treated for about fifteen years. The figures are not absolute for in the beginning too small doses were used in some of the cases, some of the patients have not been found, etc. But taking these limitations into consideration, the material is divided into three groups, one of cancroids, one of deeper skin carcinomas and one of lupus carcinomas. In the first group there were 34 cases and 19 permanent cures, 3 recurrences, 1 death and 11 improvements. Among the 19 cured cases, 12 had only a single roentgen treatment, 9 had a full dose and three had 2/3 of a dose, filtered through 3–4 mm. aluminum. Of the other 7 cases 6 were given up to as much as 3 full doses in the course of several years. Of the 11 improved cases 3 were irradiated once, 5 twice, 2 three times and 1 four times; the doses varied from 2/3 of a dose to three full doses, generally distributed over quite a long time.

The results were similar in group 2: among a total of 17 cases there were 10 cures, 4 improvements, 3 recurrences and no deaths. As in the first group the majority of the cured patients were given only one irradiation of 2/3 of a dose to a full dose.

But in group 3, of 13 cases there were no permanent cures, but 10 improvements, 2 recurrences after apparent cure, and 1 death. These results show that roentgen irradiation is not very effective in lupus carcinoma and they also show the necessity of great care in the treatment of lupus vulgaris. Possibly radium would be a better treatment for lupus carcinoma.—*Audrey G. Morgan.*

FUHS, H., and KONRAD, J. Über Erfahrungen mit der indirekten Röntgenbestrahlung von Hautkrankheiten. (On experiences with indirect roentgen irradiation of skin diseases.) *Strahlentherapie*, 1930, *35*, 239–249.

The authors have treated 157 cases of various dermatoses with indirect roentgen irradiations by using roentgen rays of 0.17 to 0.47 mm. half-value layer in copper and a dose of 100 to 200 R. The regions irradiated were as follows: thymus for psoriasis, sclerodermia and vitiligo; pituitary gland for acne, alopecia, chronic eczema, lichen urticatus, psoriasis, pruritus and chronic urticaria; the sympathetic nervous system for chronic eczema, lichen ruber planus, Raynaud's disease, pemphigus vulgaris, pruritus, sclerodermia; the spleen (in some instances including the liver) for acne, eczema, furunculosis, urticaria, strophulus, and the regional lymph glands for lupus erythematodes discoides.

The conclusion is reached that the indirect roentgen irradiation is practically valueless in the treatment of various dermatoses except some very few conditions which are on an endocrine basis. A case of diffuse alopecia occurring in a girl nineteen years of age which markedly improved following irradiation of the pituitary gland is described in detail and illustrated with photographs.—*T. Leucutia.*

GRÜTZ, O. Röntgenkastration bei Impetigo herpetiformis. (Roentgen castration in impetigo herpetiformis.) *Strahlentherapie*, 1930, *35*, 501–512.

A case of impetigo herpetiformis is described in a woman thirty-five years of age. The pustular skin eruption first occurred in the second month of the second pregnancy; it persisted through the entire pregnancy and puerperium, then it regressed only to recur with each subsequent menstruation. For this reason the author induced a temporary castration and the eruptions ceased.

The case is described because of its extreme rarity (the author was able to observe only 2 cases during a period of 10 years), and since roentgen castration led to apparent healing.—*T. Leucutia.*

ROHRBACH, R. Die Röntgenbehandlung der chronischen Paronychie. (Roentgen treatment of chronic paronychia.) *Strahlentherapie*, Jan. 9, 1930, *35*, 136–138.

The chronic paronychias not caused by a specific microorganism are very stubborn and very troublesome to the patients and unlike specific infections of the nail-bed, are very common. Treatment with antiseptic fluids and salves has very little effect. Roentgen treatment has proved very effective. The author gives 12 x with a 2 mm. Al filter and this irradiation is repeated after six weeks; if there is recurrence it is repeated again after three to six months. The joint is covered carefully so that only the terminal phalanx is exposed to the rays. Generally not all of the fingers are affected, but only the fingers of one hand, or only both thumbs, both index fingers, etc. In such cases the author made comparative tests, using roentgen rays on one hand and the usual salve treatment on the other. The results of roentgen treatment were in all cases very much superior to those of other methods of treatment.—*Audrey G. Morgan.*

BECK, A. Zur Strahlenbehandlung von Knochenmetastasen nach Mammacarcinom. (Roentgen therapy of bone metastases in mammary carcinoma.) *Strahlentherapie*, 1930, *35*, 513–517.

Three cases of bone metastases in mammary carcinoma which were successfully treated by irradiation are briefly described. In the first case the metastasis occurred to the seventh dorsal vertebra and the patient is now well for a period of over six years. In the second case the metastasis was to the pelvic bones and in the third case to the right upper femur (resulting in a pathological fracture). These latter two cases were treated only one year ago and thus

it is too soon to express an opinion with regard to their final outcome.

In conclusion, the author endorses the opinion of Borak and Kienböck that all carcinoma metastases to the bony structures should be treated systematically by radiation.—*T. Leucutia.*

Fuhs, Herbert. Zur Röntgen-Allgemeinbestrahlung mit kleinsten Strahlendosen bei Hautkrankheiten. (General roentgen irradiation with very small doses in skin diseases). *Strahlentherapie*, 1929, *34*, 862–867.

The author used a focus-skin distance of 130 cm. with the central ray adjusted to the middle of the sagittal diameter of the body and irradiated front and back on alternate days. In a few cases the sides were also irradiated. Generally one to three series of irradiations were given. A series consisted of two irradiations each front and back. The second series followed the first immediately while there was an interval of a week between the second and third. About 15 R with moderately hard rays was given with 130 kv., filtered through 4 mm. Al.

Forty-four cases were treated, including cases of furunculosis, eczema, lichen ruber planus, mycosis fungoides in the premycotic stage, pityriasis, prurigo, psoriasis vulgaris, salvarsan dermatitis and chronic recurrent urticaria. Thirty-two of the cases, or about 75 per cent, were cured or greatly improved; 11 or 1/3 of these were completely cured. In the majority of cases two series of irradiations were enough. Among the cases that were not so favorably affected were ones of stubborn desquamating eczema, lichen ruber planus, lymphogranulomatous prurigo, chronic recurrent urticaria, 2 cases of pityriasis lichenoides chronica, 2 cases of mycosis fungoides that had already been given roentgen treatment and 4 cases of stubborn psoriasis vulgaris which had resisted all the usual methods of treatment. As the method has no bad by-effects it may be used in combination with non-irritant medical treatment to shorten the course of certain skin diseases.—*Audrey G. Morgan.*

v. Jaschke, R. T. Das Kernproblem im Kampfe gegen das Uteruscarcinom. (The chief point in the struggle against cancer of the uterus.) *Strahlentherapie*, Jan. 9, 1930, *35*, 47–53.

There is a great deal of discussion as to whether operation or irradiation is the best treatment for carcinoma of the uterus, but the chief point is to treat the patient at a period when either is hopeful. It is certain that either operation or irradiation gives the best results if the carcinoma is still limited to the uterus. At present there is not more than 20–25 per cent permanent cure in cancer of the cervix but if the patients could be treated before the glands are involved there should be 75–80 per cent permanent cures. Statistics are given showing the time at which the patients first present themselves for treatment after the symptoms begin and the time that passes from the first time they come to the physician before they are sent for operation. The figures show that in about one-fourth to one-fifth of carcinoma cases the patients themselves do not come to the physician until it is too late, but in another fifth the delay is almost certainly the fault of the physician and in another fifth probably so.

Two things are necessary in order to overcome this unfortunate condition of affairs: first, instruction of the public and second, of physicians. The physician should be made to feel his great responsibility in the matter and that it is commendable for him to send a patient for surgical examination if there is the least suspicion of carcinoma, even if the examination does not confirm it. The question should be kept constantly alive in the medical journals. Popular lectures do not seem to have accomplished much in the way of instructing the public, but they have generally been given in university towns where they are least needed. Pictures and other material from museums of hygiene and public health should be sent out to the smaller towns and the physician should take it upon himself to instruct his own public in one way or another, either in his daily work with families, by means of lectures or little articles in the local newspapers; but in one way or another women should be made to feel the importance of coming for examination for any irregularity in menstruation in the cancer years. —*Audrey G. Morgan.*

Ritter, H., and Karrenberg, C. L. Thalliumepilation oder Röntgenenthaarung? (Should thallium or roentgen rays be used for epilation?) *Strahlentherapie*, Jan. 9, 1930, *35*, 116–122.

The authors believe that roentgen epilation

is unconditionally to be preferred to thallium. With increasing use of thallium severe injuries and even deaths have been reported in increasing numbers. Serious psychic disturbances, epileptic attacks, neuritis, myasthenia, adynamia and motor disturbances have been reported, in addition to the milder symptoms of vomiting, dizziness, pain in the joints, etc. More or less serious symptoms have been reported in from 8 to 58 per cent of the cases by various authors. The effective and toxic doses of thallium lie very close together so it is hard to use it without bad effects. In addition to the danger in the use of the drug it is not very effective. So on the ground of both effectiveness and lack of danger roentgen epilation is greatly to be preferred.—*Audrey G. Morgan.*

HABERMANN, R. Röntgenschadigung nach Epilation eines Kindeskopfes mit Schwermetallfilterung und ihre forensische Beurteilung. (Roentgen injury after epilation in a child with heavy metal filtration, and medicolegal judgment on it.) *Strahlentherapie*, Jan. 9, 1930, *35*, 123–129.

A child three years of age was irradiated for a mycosis or eczema first from a single field, and then four weeks later it was given a total epilation irradiation from seven fields. Three weeks after the irradiation there was a reaction of the third degree that was at first interpreted as erysipelas with ulceration; it did not heal until more than a year later with almost total cicatrization of the scalp. Its late appearance was evidently because of the excessive hardness of the rays used and the cross-firing; at first 20 per cent of a skin erythema dose was used over a single field and then 33 per cent of a skin erythema dose over 7 fields, with 0.5 mm. zinc filter.

The first expert who passed an opinion said it was the fault of the roentgenologist but the second legal opinion passed on it was that the erythema may have caused itching and scratching through which infection and erysipelas occurred, and that as this took place at the height of the roentgen reaction, the summation of the two injuries had serious results. At any rate, when irradiation is being given for dermatological conditions a dermatologist should be present unless the roentgenologist himself is a trained dermatologist.—*Audrey G. Morgan.*

SCHOENHOLZ, L., and HIRSCH, H. Histochemische Untersuchungen am Carcinoma vor und nach der Bestrahlung. (Histochemical examinations of carcinoma before and after irradiation.) *Strahlentherapie*, 1929, *34*, 273–287.

The authors studied mineral metabolism in carcinoma tissue by reducing thin sections to ash after roentgen and radium irradiations and determining the calcium content of the ash. One case is described in which radium was used and another in which roentgen irradiation was used. Two days after irradiation there was a great increase in the amount of calcium in the cancer cells at a time when no effect of the irradiation can be seen with ordinary histological examination. The authors believe from their pictures that this increase in calcium is a result of the irradiation and is not dependent on any change in the connective tissue stroma. The increased amount of calcium taken up by the cancer cells after irradiation they think is an evidence that the primary point of action of the rays is the cancer cell; this is also indicated by vacuolization and clumping of chromatin. There is no evidence that these changes are a result of action of the rays on the connective tissue particularly as the connective tissue also shows an increase in calcium after irradiation. —*Audrey G. Morgan.*

BRANDT, W. Zur Behandlung des Lupus vulgaris. (Treatment of lupus vulgaris.) *Strahlentherapie*, Jan. 9, 1930, *35*, 149–157.

Among 349 cases of lupus that were reexamined later 34.4 per cent were completely cured, 12.9 per cent greatly improved but not entirely cured, 52.7 per cent uninfluenced. The quartz lamp is the best method of local treatment. Roentgen treatment is dangerous and not very apt to bring about permanent cure, so it should be limited to only a few treatments and low doses in a few cases. It is impossible to say at present just how large a dose can be allowed. The older the lupus, the harder it is to cure. In 39.8 per cent of the cases the lupus developed before ten years of age, in almost 70 per cent before twenty. Among 288 lupus patients only 1.73 per cent had had pulmonary tuberculosis according to their statements. In 34.8 per cent there was tuberculosis in the family. In the examination of 106 patients who had died of lupus it was found that about 40

per cent had had an active tuberculosis not localized on the skin. Among 86 lupus patients 40.69 per cent died of tuberculosis.—*Audrey G. Morgan.*

Joseph, Eugen. The treatment of malignant tumors with radium catgut. *Lancet*, Jan. 4, 1930, *1*, 21–22.

The author believes that the best result with radium when used on malignant tumors is obtained by an even distribution throughout the extent of the tumor for the longest possible time. The retention of the radium is dangerous and it has been shown that the largest quantity which a man weighing 70 kg. can tolerate without grave danger is less than half a milligram. This, plus the expense is perhaps why this method has not been adopted.

The use of radium silk, or better, radium catgut, in sewing up the abdominal wall after the removal of a tumor would perhaps prevent recurrence in the wound and would reduce the incidence of stitch infections. The radium should be so distributed over the gut that the dose in the length to be used shall not exceed half a milligram. Treatment with radium catgut can be carried out in the above-mentioned manner in sewing abdominal wounds as an inoperable tumor may be threaded across and across with lengths of radium catgut.—*G. R. Miller.*

Halberstaedter, L., and Seiffert, A. Zur Strahlenbehandlung des Kehlkopfcarcinoms. (Radiation treatment of laryngeal carcinoma.) *Strahlentherapie*, 1930, *35*, 518–522.

During the past few years the authors have treated 20 cases of carcinoma of the larynx by using a modification of the technique of Finzi and Harmer. As is known these authors introduce the radium through a laryngo-fissure and place it in actual contact with the tumor for a period of four and a half to eight days.

The present authors make use of the same route. However, instead of applying the radium in the form of needles as is done by Finzi and Harmer they have constructed an applicator which is 2 cm. long and 1.5 cm. wide and which contains 10 to 15 mg. radium element filtered by 1 mm. platinum. The posterior aspect of the applicator is filtered by 1 mm. lead so as to protect the laryngeal tissues. The applicator is placed in direct contact with the tumor and the wound is closed aseptically (without performing tracheotomy which according to the authors is unnecessary). Eight days later the wound is reopened and the applicator removed. In case that the lesion extends to both sides of the larynx two applicators are introduced, one on each side. However in this instance the radium is placed between the perichondrium and the laryngeal cartilage (without laryngo-fissure) and is left in situ for a period of only four to five days.

The immediate results were very satisfactory but it is too soon to draw conclusions as to the final results.—*T. Leucutia.*

Gask, G. E. Treatment of epithelioma of the tongue by radium. *Lancet*, Feb. 1, 1930, *1*, 223–227.

The results of the various surgical procedures used in the treatment of cancer of the tongue compiled at St. Bartholomew's Hospital in London, showed a five year cure of 17.1 per cent. Other Island and Continental clinics gave statistics which varied between 14.3 per cent to as high as 30.8 per cent for three year periods. Continental clinic figures for radium alone report 45 per cent of five year cures as regards the primary site and 20 per cent of absolute five year cures.

In St. Bartholomew's Hospital the primary tongue growth has been treated by radon seeds of strength varying from 1.5 to 3 mc., and the glands in the neck by radium needles inserted by puncture. The primary lesion disappeared in the majority of instances except in those cases where biopsy showed the lesion to be histologically Grade 1.

The treatment of the lymphatic glands presented the main difficulty. The method of irradiating them with needles did not always prove satisfactory. The Westminster Hospital secured their best results by dissection of the glands followed by irradiation. This was also the method of choice at the Radium Institute of Paris.

With these results in view, the procedure in the future will be block dissection whenever possible, to be followed by irradiation.—*G. R. Miller.*

Carling, Francis Rock. Radium teletherapy. *Brit. M. J.*, Feb. 8, 1930, *1*, 232–234.

An apparatus designed at the Westminster Hospital in London to meet the problem of the most effective and economical use of the 4

grams of radium available consists of a bomb which holds twenty containers arranged in groups of five. Each group can be withdrawn from use by pulling the appropriate knob outside the bomb.

By use of high and low stretchers two patients may be treated at the same time, the bomb being placed between the stretchers on a suitable apparatus.—*G. R. Miller.*

JACOBS, J. Zur Behandlung der Lymphogranulomatose. (Irradiation of lymphogranulomatosis.) *Strahlentherapie*, 1930, *35*, 533–538.

Thirty cases of lymphogranulomatosis have been treated by the author during the past five years by repeated irradiation of the involved lymph nodes with doses of from 30 to 50 per cent S. U. D. (0.5 mm. Cu and 190 kv.). For the past two years the roentgen irradiation has been combined with the administration of dextrocid (10 c.c. of a 30 to 50 per cent solution). One case which has remained well now for a period of two years is described briefly in order to illustrate the method of procedure.—*T. Leucutia.*

KONRAD, JOSEF. Behandlungserfolge mit Buckys Grenzstrahlen in der Dermatologie. (Treatment results with Bucky borderline rays in dermatology.) *Strahlentherapie*, 1930, *35*, 567–580.

Four hundred cases of various dermatological conditions were treated by the author with borderline rays (10 kv., 10 ma., and 10 cm. skin target distance, or in more generalized cases, 15 cm. skin target distance). Three different tubes were used for this purpose and it is interesting to note the great variation which existed in the emission of the rays (due to the different window thicknesses) of these tubes. The ratio was as follows: first tube, 40 R; second tube, 150 R; third tube, 81 R. It was also found that the emission changed with use, due to the destruction of the celluloid coat of the Lindemann window.

The borderline rays were of especial value in the treatment of alopecia areata, and of skin conditions of the hairy scalp, in verrucae planae juveniles, in verrucae vulgares of the hands, in clavi plantares, in eczemas of the eyelids, in certain tuberculous lesions (tuberculosis verrucosa cutis and erythema induratum Bazin), in pemphigus benignus, lichen ruber acuminatus and naevus flammeus.

In seborrhea, acne, various eczemas, staphylococcic infections of the skin and skin carcinomas roentgen rays were of greater benefit.

More recently the author has used the borderline rays in gonorrheic epididymitis (up to a dose of 100 R) with remarkable analgesic effect.—*T. Leucutia.*

BORAK, J. The analgesic effects of roentgen rays with especial consideration of bone metastasis of cancer. *Radiology*, April, 1930, *14*, 328–338.

In the opinion of the author the fundamental differences in the analgesic effect of roentgen rays and pure analgesics lies in the fact that the roentgen rays can influence solely a pain that has arisen under pathologic conditions. In other words, the roentgen rays act as an analgesic only when they act therapeutically and only to the extent that they exert healing effects. The bone metastases of cancer are of comparatively slight virulence and the most sensitive of all carcinomas to the roentgen ray. They do not produce pain until the periosteum or nerve trunks adjacent to the bone become involved. By roentgen therapy growth of the bone metastasis is not merely checked, but caused to retrogress or disappear. When the dose is properly adjusted, roentgen therapy thus has a lasting effect on the pain, suppressing it for at least several years. Borak cites cases of bone metastasis in which pain was suppressed and at necropsy the metastasis, which previously was demonstrable roentgenographically, had completely disappeared.—*J. D. Camp.*

TOWNE, EDWARD B. Treatment of pituitary tumors; the role of the röntgen-ray and of surgery therein. *Ann. Surg.*, Jan., 1930, *91*, 29–36.

Towne states that few neurosurgeons believe in the efficacy of the roentgen ray in the treatment of adenomas of the pituitary gland. Some have given it a brief trial before operation, and many use it after operation. In 1926 Towne reported 2 cases of pituitary tumor in which the visual fields and visual acuity had been restored to approximately normal for

periods of three and two years respectively by roentgen treatment. These cases and a review of the literature led to the following deductions: (1) Cushing's statistics showed that 20 per cent of pituitary adenomas were cystic, and that about 20 per cent of his patients conserved useful vision for more than five years after operation. The remaining 80 per cent either did not regain useful vision, or had recurrences after a period of about two years. These figures suggested that the results of surgery were lasting only when a cystic tumor was encountered. (2) Towne's cases and others in the literature showed excellent results for periods of from two to thirteen years after roentgen treatment. It must be assumed, Towne states, that these were solid tumors, as cysts would not respond to roentgen therapy, and therefore there was reason to believe that 4 out of 5 pituitary adenomas could be treated more safely and with more lasting results by roentgen radiation than by surgery.

Towne's present paper deals with the subsequent history of the 2 patients who were the basis of his first report and also with the records of 3 others who have been under observation for more than two and a half years.

Case 1. Restoration of normal visual acuity and fields for five years by roentgen treatment. Recurrence, failure of roentgen therapy, temporary improvement following operation, and death seventeen months after recurrence.

Case 2. Restoration of normal visual acuity and fields by roentgen treatment. Recurrence after two years, eight months; failure of roentgen treatment. Prompt improvement after evacuation of cyst, lasting to date, three years after operation.

Case 3. Bitemporal hemianopsia not improved by roentgen treatment; condition stationary three and one-third years later; operation refused.

Case 4. Blindness for three months. Slight response to roentgen radiation; no response to surgery.

Case 5. Bitemporal hemianopsia with loss of central vision in left eye, cured by roentgen radiation. Normal visual acuity and fields two years, ten months later.

Most of the roentgen treatments in these cases were given by Dr. W. E. Chamberlain and Dr. R. R. Newell at Stanford University Hospital. The usual treatment is exemplified by that given in Case 5, which Dr. Newell summarized as follows: "200 R filtered x-ray (lambda effective equals 1.17 Ångströms) to each of 5 areas, each temple, forehead, vertex and occiput, given every month. These were divided among three days on each monthly series. The areas were 9×9 cm. and the tube distance 31 cm."

Numerous scattered reports of pituitary adenomas are appearing in the literature which have been favorably influenced by roentgen therapy. It will be unfortunate if the cases are not selected carefully by physicians trying this method of treatment. Only adenomas of the anterior lobe, which enlarge and destroy the sella, are amenable to roentgen therapy. Other tumors in the region of the chiasm may give the characteristic picture in the visual fields, but not the changes in the sella and none of these will respond to roentgen radiation. There should be cooperation between the ophthalmologist, roentgenologist and the neurosurgeon in the treatment of pituitary adenomas.

Conclusions. 1. Eighty per cent of pituitary adenomas are solid, and 20 per cent are cystic.

2. Twenty per cent of patients retain useful vision for more than five years after operation; 80 per cent show no improvement or, after more or less marked improvement, have recurrences after about two years.

3. Operative treatment of pituitary adenomas has a mortality ranging from 7 per cent upward; roentgen treatment has no mortality.

4. Cases are reported which illustrate long-standing favorable results from roentgen treatment, and show that if the result is not good, a cystic tumor favorable for surgery maybe diagnosed.

5. The present custom of following surgery immediately with roentgen treatment confuses the issue. The two methods may be used separately without jeopardizing the patient's chance for a cure.

6. It is proposed that all pituitary adenomas be treated by roentgen radiation under the observation of the ophthalmologist and the neurosurgeon, that the treatment be stopped as soon as improvement begins, and that surgery be undertaken short of six months only when visual acuity and fields recede under roentgen treatment.—*R. S. Bromer.*

MOGILNITZKY, B. N., and PODLJASCHUK, L. D. Zur Frage über die Wirkung der Röntgenstrahlen auf das zentrale Nervensystem. (The effect of roentgen rays on the central nervous system.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*. Dec., 1929, *40*, 1096–1108.

The authors investigated the effect of the roentgen rays on the central nervous system in 40 animals (16 dogs and 24 rabbits). The skull was irradiated either in its entirety or through individual fields (frontal, parietal, temporal and oblongata region), animals of identical age, size and weight being used as controls. The irradiation was carried out with doses of from ¾ to 10½ S.U.D. per field, with 120 to 180 kv., 3 mm. Al. or 0.5 mm. Zn and 1.0 mm. Al.

According to the length of the time of observation following the irradiation, the animals were divided into two groups: (1) those observed from one to six months, and (2) those observed from one to sixteen days.

It was found that in adult animals large doses of roentgen rays produced no changes whatever on the ganglion cells of the brain. There was, however, some cellular reaction of the mesenchyme apparatus, consisting in proliferative processes and alterations of the permeability of the blood vessels.

In young animals, the roentgen rays led to degenerative atrophic changes of both the mesenchyme apparatus and the ganglion cells of the cortex, this signifying that age and constitution are important criteria in the irradiation of the brain.

It was also found that in adult animals the irradiation with fractional doses led to a breaking down of the "hemato-encephalic barrier". The meaning of this will be discussed in a future article.—*T. Leucutia.*

MOGILNITZKY, B., and PODLJASCHUK, L. Röntgenstrahlen und sogen. "hamato-enzephalische Barriere". (Roentgen rays and the so-called "hemato-encephalic barrier".) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Jan., 1930, *41*, 66–75.

In the course of roentgen irradiation of the brain it was observed that in certain instances a functional disturbance of the mesenchyme apparatus developed, leading to a breaking down of the hemato-encephalic barrier.

As is known, the hemato-encephalic barrier (Stern) consists in a sort of protection of the central nervous system against toxins and poisonous substances circulating in the blood. It is yet undetermined which of the tissues is specifically connected with this peculiar function of the mesenchyme apparatus.

The authors performed a number of experiments (in rabbits and dogs) in order to determine the exact effect of various doses of roentgen rays (150 kv., 3 mm. Al.) on the hemato-encephalic barrier. A 1 to 2 per cent solution of trypan-blue and in some instances a 2 per cent solution of saccharated ferrous oxide were used intravenously for testing the intactness of the barrier. Under normal conditions, neither of these substances passes from the blood into the brain tissues proper, but as soon as the brain is irradiated (with fractional doses) both the trypan-blue and saccharated ferrous oxide may appear in certain tissues of the brain.

From the point of view of the dose applied, the experiments were divided into four groups: (1) massive radiation in one sitting with doses from 3½ to 10½ S.U.D. (10 rabbits).

The trypan-blue (and in some instances the saccharated ferrous oxide) was injected preliminary to or at different intervals following the irradiation. In none of the instances was there any effect on the hemato-encephalic barrier. (2) Fractional irradiation with doses of from 2 to 5 S.U.D. (8 rabbits and 2 dogs). Here trypan-blue and saccharated ferrous oxide were injected at different intervals following the administration of fractions of radiation. It was found that in addition to the already described morphologic changes of the mesenchyme apparatus (see above abstract) there were also physico-chemical changes resulting in a breaking down of the hemato-encephalic barrier. Both the trypan-blue and the saccharated ferrous oxide lodged (adsorbed) in the endothelium and the perivascular glia elements, indicating that a change in the permeability of the vascular system resulted. (3) In a third series of experiments (15 rabbits) it was attempted to determine the beginning and the actual duration of the adsorption phenomena and it was found that both the trypan-blue and saccharated ferrous oxide disappeared within three days following the injection. A repetition of the fractional irradiation within twenty days reestablished the adsorption phe-

nomena but further repetition of the irradiation remained without influence on the hematoencephalic barrier. (4) Mild irradiation with doses of from 3 to 2 H (4 rabbits). In these experiments a mild adsorption phenomenon was observed, however without any morphologic changes.

The conclusion is reached that roentgen irradiation of the brain tissues with fractional doses leads to a breaking down of the hematoencephalic barrier, due chiefly to changes in the permeability of the vascular system of the mesoglia.—*T. Leucutia.*

Gabriel, G. Über die Beeinflussung des vegetativen Systems durch die Röntgenstrahlen. (Effect of roentgen rays on the vegetative nervous system.) *Strahlentherapie*, 1929, *34*, 813–822.

The vagus and sympathetic were irradiated on the right side of the neck in rabbits and electrocardiograms made to determine the effects. The protocols of the experiments are given and electrocardiograms reproduced. The electrocardiograms show a disturbance of balance of the vegetative system and an increase of vagus tonus. When the heart alone was irradiated with large doses the electrocardiograms showed that its function was disturbed. The T and P peaks were distinctly smaller than in non-irradiated animals and there was disturbance of heart rhythm, but this was not constant. Unlike the changes caused by irradiation of the vegetative system these changes did not disappear completely when the irradiation was stopped. No severe chronic injuries were seen for the time the observations were continued. It was impossible to tell from the electrocardiograms whether the point of action of the rays was the myocardium or the nervous system.—*Audrey S. Morgan.*

Pfahler, George E., and Parry, Leo D. Results of roentgen therapy in carcinoma of the breast. *J. Am. M. Ass.*, Jan. 11, 1930, *94*, 101–105.

Nine hundred and thirty-nine private cases of breast cancer treated between June, 1920 and June, 1926 are reviewed.

The end-results are affected by the type of cancer, age of patient, stage and rapidity of growth, extent of metastatis, regions invaded, physical resistance of the patient, duration of symptoms before operation and irradiation, and the duration of the recurrence.

The ages varied from sixteen to eighty-five years, 64.4 per cent being between thirty and fifty-five years; 1.3 per cent were males. In 90 per cent of cases a lump, pain or an injury was the first sign. The average duration of symptoms before application for any kind of treatment was nineteen months, and the average time between operation and irradiation was fifteen months.

Grading of the degree of malignancy by microscopic examination was not found to be of value in prognosis.

Preoperative plus postoperative irradiation preferably beginning two weeks after operation is advised. In cases without glandular involvement so treated there were 66 per cent of five year cures. In advanced cases with glandular involvement there were five year cures in 46 per cent, while 38 per cent of totally inoperable cases were made operable by preoperative irradiation and 10 per cent of these were alive after five years.

Postoperative treatment alone in cases without preoperative glandular involvement gave 89 per cent of five year cures. Cases with preoperative glandular involvement showed 47 per cent of five year cures. Review of statistics recorded in the literature shows 77 per cent of five year cures by surgery alone in cases without glandular involvement, and 74 per cent of five year cures in such cases when treated with both surgery and postoperative irradiation. In the literature cases with glandular involvement show 20 per cent of five year cures by surgery alone, and 35 per cent when postoperative irradiation is added.—*G. R. Miller.*

von Ammon, Ernst. Die Erfolge der Strahlenbehandlung bei Uterusmyomen und hämorrhagischen Metropathien. (Results of radiotherapy in myomas of the uterus and hemorrhagic metropathies.) *Strahlentherapie*, 1929, *34*, 457–500.

Fifteen thousand cases are reviewed from the literature with tables showing the details of the results. Cure was brought about in 96 per cent of cases of myomas and hemorrhagic metropathies by radiotherapy. There were 3.9 per cent failures and a mortality of only 0.1 per cent, results rarely attained in any field

of medicine. Operative treatment can never show such results, for even with all improvements in operative technique and after-treatment, the danger of operation can never be entirely overcome. The success of radiotherapy is also indicated by the fact that it is being used more and more all the time; from the beginning of radiotherapy in 1908 up to 1921, 11,056 cases were treated, and from 1922 and 1927, 15,937 cases. In 1920 and 1921 there was a slight increase in the percentage of cures, which then fell to the former figure, due to extension of the indications and resultant inclusion of cases that were harder to cure. Careful diagnosis and indications and accurate dosage, and for radium the strictest asepsis, will improve the results still further.—*Audrey G. Morgan.*

FÜRST, WALTER. Untersuchungen über die Dosierung harter Röntgenstrahlung aus Fernfeldern bei der Behandlung des Collumcarcinomas. (Dosage of hard roentgen rays from distant fields in the treatment of carcinoma of the cervix.) *Strahlentherapie*, 1929, *34*, 340–380.

Twelve cases are described in which carcinoma of the cervix was treated with double tubes, and a detailed discussion is given of the effects of double tube irradiation as compared with that of single tubes. The author concludes that on irradiating from distant fields with two tubes at the same time the maximum dose for the skin is not the same as the maximum dose for the deeper tissue layers and therefore for carcinoma of the cervix. The maximum dose for the deep tissue layers and for the body in general is lower than that for the skin, in some cases considerably lower. So skin erythema cannot be used as a measure of dosage, at least for a high dosage of rays given within a short time. If biological supplementary doses are necessary the amount required depends not only on the focus-skin distance but also on the charge of the tube. A blood examination should be made before every irradiation in order to get evidence as to whether and when further irradiation or operation is necessary.—*Audrey G. Morgan.*

FÜRST, WALTER. Untersuchungen über die Dosierung harter Röntgenstrahlung aus Fernfeldern bei der Behandlung des Collumcarcinomas. (Dosage of hard roentgen rays from distant fields in the treatment of carcinoma of the cervix.) *Strahlentherapie*, 1929, *34*, 501–540.

For the author's investigations of the dosage of hard roentgen rays from distant fields in the treatment of carcinoma of the cervix it was necessary to establish biological standard values for single and double tube apparatus and for near and distant fields. These standard values had to be determined empirically and not from any theoretical calculations, and then fixed by technical methods of measurement.

In the course of his work he found that skin erythema is of very secondary importance in distant irradiation with hard rays. There may be danger of injury to deep tissues before there is any very considerable degree of skin erythema. Such injuries may appear in the form of infiltrations of the pelvic connective tissue and are not necessarily limited to the symptoms that occur after over-dosage applied to the bladder and intestine. It is particularly important to follow up the blood picture in judging the general resistance of the body.

The measurements differ somewhat depending on the patient's form. So the maximum doses given are based on primary irradiation and superficial and deep intensity on the phantom, though measurements can be taken on the surface of the patient's body and in the vagina with chambers independent of wave length.

If the irradiation is given in as short a time as possible the maximum doses for hard roentgen rays from distant fields in the treatment of carcinoma of the cervix are as follows:

For 2 ma. tubes, double tube arrangement, 60 cm. from the focus to the skin, the maximum dose of primary irradiation is 1430 R, measured on one of the double tubes with fields of 18×24 cm. and 9×24 cm.; the surface intensity is 2207 R measured for fields 18×24 cm. and 9×24cm.; the deep intensity is 1863 R measured for fields of the same size.

For 4 ma. tubes, double tube arrangement, 60 cm. distance from the focus to the skin, the maximum dose is: primary radiation 1588 R, measured on one of the double tubes for fields of the same size as above; surface intensity 2352 R, with fields of the same size; deep intensity 2128 R with fields the same size.

For 4 ma. tubes, double tube arrangement,

100 cm. focus-skin distance the maximum dose is: primary irradiation 1068–1228 R measured on one of the double tubes with a field 18×20 cm.; surface intensity 1556–1696 R, with a field of the same size; deep intensity 1524–1664 R with a field of the same size.—*Audrey G. Morgan.*

Bowing, Harry H., and Fricke, Robert E. Results obtained in the treatment of carcinoma of the cervix uteri with radium and x-rays. *Radiology*, March, 1930, *14*, 211–216.

The authors reviewed 1094 patients treated during the decade from 1915 to 1924 inclusive, of whom 1001 were traced, and found that in the small operable group, operated on and subsequently treated by irradiation, 75 per cent survived five years. Of the borderline cases, 61.52 per cent of the patients were living after five years, and in a group previously treated elsewhere there were 24.82 per cent five year survivals.—*J. D. Camp.*

St. Simon. Zur intrauterinen Radiumanwendung. (Intrauterine use of radium.) *Strahlentherapie*, 1929, *34*, 859–861.

The author criticizes the usual radium carriers used for intrauterine treatment and describes and illustrates one of his own. It is a nickeled brass casing curved like a Hegar dilator; it has many holes in it so that the secretion can flow out. The normal length is 7 cm. though longer or shorter ones can be made for different lengths of the uterine canal. The length of the filter is calculated for the Dominici tubes 3.7 cm. in length that are generally used as a source of radiation. A supplementary filter of greater length with a closing piece can be used when two shorter carriers are to be used to irradiate both cervix and body. The thickness of the wall of the carrier combined with that of the radium capsule amounts to 1.5 mm. brass. The size of the carrier is that of a Hegar dilator No. 8 or 10. At the vaginal end there is a disk adapted to the convexity of the portio in contact with the two handles of the terminal piece. The object of this piece is to hold the radium firm and keep the gauze tampon at a distance from the disk so that the discharge of secretion will not be interfered with. The carrier can be taken apart and boiled. It is put in with a dressing forceps.

A certain amount of soft secondary irradiation from the carrier is desirable in malignant disease and also where the uterine mucous membrane is to be cauterized, as for example in hemostasis.—*Audrey G. Morgan.*

Binkley, George E. Advantages and limitations of radiation in the treatment of rectal cancer. *Radiology*, March, 1930, *14*, 207–210.

External irradiation, in the opinion of the author, constitutes the first step in radiation therapy of all rectal cancer, and in certain cases may be the only form of treatment necessary. The effect is limited by the depth of the tumor, the tolerance of the skin, and the radioresistance of the cancer. External radium irradiation is more effectual than high voltage roentgen rays. The two types of radiation may be combined advantageously.—*J. D. Camp.*

Bowing, H. H., Fricke, R. E., and Smith, N. D. Treatment of malignant tumors of the rectum by radium and roentgen rays. *Radiology*, Nov., 1929, *13*, 443–450.

The authors report the results in 127 cases of malignant disease of the rectum treated at The Mayo Clinic with radium and roentgen rays. The majority of the cases were inoperable due to the size and extent of the primary lesion, or local metastasis, metastasis to important viscera or the patient's poor general condition. Adenocarcinoma of moderate malignancy predominated. Twenty-three per cent of the patients lived from three to six months, 18 per cent from six to nine months, and 34 per cent longer than nine months. Almost 4 per cent survived eighteen to twenty-four months, and slightly less than 3 per cent lived twenty-four months or more. The writers regard it as evident that the lives of these patients were prolonged and that the activity of the disease was reduced thus diminishing distressing complications. Improvement noted consisted largely in lessening of rectal discharge and pain, reduction of the size of the tumor and cessation of bleeding.—*J. D. Camp.*

Hirschberg, M. Dauerheilung eines Tibiasarkoms mit Röntgenstrahlen und atrophische Vorgänge in der Bestrahlten Muskulatur. Spätrophie in der Halsmuskulatur nach einer einmaligen, vor 15 Jahren ausge-

führten Oberflächenröntgenbestrahlung. (Permanent cure of a sarcoma of the tibia with roentgen rays and atrophy of the irradiated muscles. Late atrophy of the muscles of the neck after superficial roentgen irradiation fifteen years before.) *Strahlentherapie*, 1929, *34*, 421–424.

The first patient was a girl then nine years of age on whom roentgen treatment for a sarcoma of the tibia was begun on Dec. 20, 1918. Apex apparatus, AEG electron tube, 38 cm. spark gap, 2 ma., zinc-aluminum filter. The tibia was irradiated from inside, outside and behind, 20 minutes per field; three series at intervals of 8 days. In April, 1919, the three series were repeated. About two weeks after the last irradiation there was intense erythema with cyanosis, swelling and pain over the tumor. In May, 1919, the signs of reaction had disappeared and the tumor was smaller. In July, another series of irradiations was given. In December, the tumor had disappeared; the skin over the anterior surface of the tibia was pigmented. Now ten years after the irradiation there is no sign of tumor but the muscles of the calf are greatly atrophied. The patient first noticed the atrophy in March, 1923, shortly after menstruation began. The author questions whether this was the effect of irradiating a child's muscles which remained latent for a long time and only became manifest at the time of puberty. Such a late injury from roentgen irradiation seems to be shown in another case that he treated. A boy of eight was sent to him in 1912 for trichophytosis. He irradiated five fields without a filter with 2 ma. and 16–18 cm. spark gap. The Sabouraud-Noiré dose was kept a little below the full dose. The hair fell out in two weeks and grew again afterward. At one place on the nape of the neck the hair remained scanty and telangiectases later developed at the border of the hair. The author did not see the patient again until 1928 when he was sent to him by a neurologist and a surgeon for examination of the cervical spinal column. The muscles of the nape of the neck and the upper border of the back muscles had atrophied greatly within the past year. The neurologist could not find any cause for it. The area of muscle atrophy coincided with the irradiated area. The author thinks this muscle atrophy too was caused by the superficial irradiation fifteen years before.—*Audrey G. Morgan.*

MISCELLANEOUS

NEMENOW, M. I. Das Staatsinstitut für Röntgenologie, Radiologie und Krebsforschung in Leningrad. (The State Institute for Roentgenology, Radiology and Cancer Research in Leningrad.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Dec., 1929, *40*, 1069–1087.

The Institute which is only twelve years old has the following divisions: (1) physical division, for standardization of measuring instruments, preparation of radon apparatus, and fluid air, and for various scientific investigations: (2) a clinical division (120 beds) which consists of a medical, surgical, gynecological and radiotherapeutic department; (3) radiobiologic division; (4) institute for cancer research comprehending biochemical, pathological, bacteriological, serological, botanic-microbiologic, and experimental histological and biological laboratories; (5) amphitheatres, museums, workshops, etc.

The Institute is under the actual direction of a roentgenologist (Nemenow) and has a staff of several professors, assistant professors, aspirants and interns, making a total of 75.

During each year two four month courses are given to practicing physicians from every part of the republic. The Institute publishes the *Annales de Roentgenologie et Radiologie* which lately has become the central organ of Russian roentgenologists and radium therapists.

A total of 150 scientific articles have been published since the foundation of the Institute. The titles of the most important articles are included.—*T. Leucutia.*

HERZ, RICHARD. Über die Nachprüfung der Belichtungszeiten an Diagnostikapparaten. (A check-up of the time of exposure in diagnostic apparatus.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Nov., 1929, *40*, 840–842.

The author describes a simple method for the check-up of the time of exposure of various roentgen apparatus. A gramophone in which the roentgen film serves as the record is used and a lead plate with six small holes arranged radially at definite distances is mounted above the film. For the actual determination of the

time of exposure the gramophone is set in motion (thus rotating the film underneath the lead plate) and the exposure is made through the individual holes (the other holes being covered by lead) for successive apparatus. After the film is developed the actual length of the ring-shaped exposure lines is measured and the time of exposure checked. With extremely short exposures (from 1/100 to 3/100 sec.) the error is less than 2 to 3 per cent.—*T. Leucutia.*

Dioclès. L'examen des stéréogrammes a l'aide des jumelles. (The reading of stereograms with the aid of binoculars.) *J. de radiol. et d'électrol.*, Jan., 1930, *14*, 54–56.

The author has constructed binoculars both for the orthoscopic and pseudoscopic view of stereograms. The advantage of this procedure is that the roentgenograms can be viewed at rather short distances, that they present normal dimensions and that they can be viewed both orthoscopically and pseudoscopically without changing of the films.—*T. Leucutia.*

Braun, Oskar. Der analytische Felderwähler. (The analytic field selector.) *Fortschr. a. d. Geb. d. Röntgenstrahlen*, Nov., 1929, *40*, 834–839.

The author describes a new method for field selection in deep roentgen therapy which consists in the mathematical calculation of the depth dose with the aid of the intensity law. Samples of curves are presented for the analytic determination of the number of fields and of the surface doses for various conditions.

In the near future a logarithmic slide rule will be prepared for the easier calculation of the values of the curves.—*T. Leucutia.*

Fernau, Albert. Wie sollen Radiumträger beschaffen sein? (How to make radium carriers.) *Strahlentherapie*, 1929, *34*, 855–858.

The author criticizes the radium carriers commonly used, particularly because the radiation from them is not homogeneous and because there is a great loss of radium in removing it for use elsewhere. He has had a carrier made which can be kept indefinitely and there is no loss on removal of the radium. It is a capsule made of nickeled silver and may be made in various forms and sizes to be used for various parts. It is filled with potassium sulphate to determine the amount necessary to fill the cavity which is then removed and mixed with the radium salt. The amount required is then introduced into the capsule with a metal funnel, the capsule closed and the lid soldered on. The metal wall that is to be placed on the part of the body to be treated is 0.3 mm. thick; the opposite wall is 3 mm. thick. When the radium is wanted for other purposes it can be removed almost without loss. The radium containing potassium sulphate is treated with dilute hydrochloric acid, on which the potassium sulphate goes into solution and the radium can be collected almost without loss as insoluble sulphate.

Needles are often not well filled either. They are filled from the tip and the radium collected in the opposite end of the needle leaving the tip free. If such a needle is used in a tumor of the mouth, for instance, the tip which is in the tumor has no effect and the part that protrudes outside and does contain radium may injure normal parts. The needles should be closed at the top with a cap that screws off and filled from the top; they should be filled under roentgen control so as to know just where the radium is. In filling tubes care must be taken to see that the filling is homogeneous and that the radium does not collect at one place or change its position. When radium carriers are bought they should be examined roentgenologically to see if they are filled homogeneously.

The author then describes the details of his chemical method of recovering radium without loss from needles; this is important as the price of radium is so high.—*Audrey G. Morgan.*

Risse, O. Einige Bemerkungen zum Mechanismus chemischer Röntgenreaktionen in wassrigen Lösungen. (Mechanism of chemical roentgen reactions in aqueous solutions.) *Strahlentherapie*, 1929, *34*, 578–581.

If water is irradiated with ultraviolet rays in an air-tight rock crystal vessel no hydrogen peroxide is produced but if it is irradiated with roentgen or beta radium rays hydrogen peroxide is produced. The question is whether the necessary oxygen for the formation of the hydrogen peroxide comes from the oxygen physically dissolved in the water or from the H_2O molecule. Experiment has shown that it comes for the most part from the dissolved atmospheric oxygen. When the water was boiled

for several minutes and closed air-tight before irradiation, hydrogen peroxide was not formed. So in examining the changes brought about by roentgen or beta irradiation in any substance dissolved in water unless atmospheric oxygen is carefully excluded the effect of the peroxide that is formed must be taken into consideration. Fricke's transformation of ferrosulphate into ferrisulphate illustrates this. It is logical to suppose that the transformation of a substance sensitive to roentgen rays would run parallel to its concentration. But Fricke's reaction was independent of concentration throughout a wide range, that is, the same amount of radiant energy transformed the same number of molecules, no matter whether there were 25 molecules to the cubic centimeter or more or less. Fricke concluded from this that the ferrosulphate molecule in itself is not sensitive to the rays, but is transformed secondarily by some product that develops in the water. Evidently hydrogen peroxide is formed first and reacts with the ferrosulphate. But Fricke saw a transformation even when oxygen was excluded, though it was only half as great as in the presence of oxygen. This must have been due to a chemical activation of the water by the rays. Hydrogen peroxide is also decomposed by roentgen, beta and ultraviolet rays. The author describes a method of calculating the decomposition of hydrogen peroxide quantitatively and the rapidity of such reactions as Fricke's ferrosulphate reaction and of obtaining evidence in this way as to whether a substance is transformed directly or indirectly by means of activated water.

The roentgen and beta rays may change water into atomic hydrogen and oxygen and two O atoms may combine to form molecular oxygen which is finally hydrated to H_2O_2. Or water may be split into H and OH and two of the OH groups unite to form hydrogen peroxide. In either case two H atoms remain which can again combine with molecular oxygen dissolved in the water to form hydrogen peroxide. The author is testing this hypothesis experimentally. It is obvious that such a decomposition in the body, which contains so much water, would be of the greatest importance.—*Audrey G. Morgan.*

DEL BUONO, P. Weitere Untersuchungen über die Wirkung der Röntgenstrahlen auf das vegetative System. (Further studies of the effect of roentgen rays on the vegetative system.) *Strahlentherapie*, 1929, *34*, 301–312.

While irradiation of other parts of the body causes leucopenia, fall of blood pressure and hypoglycemia, irradiation of the region of the hypophysis causes hyperleucocytosis accompanied by moderate hypertension and hyperglycemia. Irradiation of the hypophyseal region may cause an increase of tonus of the hypophysis or it may act on the vegetative centers of the midbrain which regulate blood pressure, glycemia and temperature. In that case irradiation of the hypophysis would cause an increase of sympathetic tonus, one of the effects of which is a rise of blood pressure. Glycemia is also increased by the action of the vegetative nerves on the liver cells in sympathicotonia. In the author's experiments on rabbits blood pressure was increased immediately after the irradiation by 0.05 to 0.10 per cent of the original value; after six hours by 0.10 to 0.20 per cent and after twenty-four hours the values were normal again. The author says there is a roentgen shock just as there is a colloidoclastic shock which causes leucopenia on irradiation of the body in general but the leucocytosis on irradiation of the hypophyseal region he thinks is caused by the action of the rays on the neurovegetative centers of the midbrain. To prove this absolutely it would be necessary to remove the hypophysis and irradiate the vegetative centers but this is technically impossible because it is hardly possible to remove the hypophysis without injuring the midbrain centers. But the experimental results indicate that it is action on the neurovegetative centers rather than on the hypophysis that causes the above-mentioned changes.—*Audrey G. Morgan.*

JUGENBURG, ANNA. Über die Einwirkung der Röntgenbestrahlung auf den Gasstoffwechsel. (Effect of roentgen irradiation on basal metabolism.) *Strahlentherapie*, 1929, *34*, 288–300.

Experiments on guinea pigs are described which show that roentgen irradiation affects basal metabolism more or less, depending on the size of the dose used. General irradiation with doses as large as half an erythema dose which cause considerable lowering of basal metabolism and decreased intensity of oxida-

tion, bring about depression of nitrogen metabolism and retention of nitrogen in the organism. The changes in basal metabolism and nitrogen metabolism caused by roentgen irradiation with large doses are so rapid that the animals die fourteen to sixteen days after the irradiation. General irradiation with small doses causes a brief and slight depression of basal metabolism and oxidation. But after a comparatively short period of three to four weeks the basal metabolism shows a tendency to return to normal. In some cases after irradiation with small doses there was even an increase in the intensity of oxidation. On roentgen irradiation with small doses there was a considerable increase of the respiratory quotients, which suggests that irradiation causes increased oxidation of carbohydrate. In the cases in which the respiratory quotient increases to more than 1 after the irradiation, fat must be formed from carbohydrate. Irradiation of the abdomen of the guinea pig alone causes a considerable increase in weight and increased basal metabolism, without affecting the intensity of oxidation particularly. Irradiation of the head and neck in some cases causes a decrease in weight and a fall of basal metabolism; in other cases this form of irradiation does not have any special effect on basal metabolism.—*Audrey G. Morgan.*

Rubinstein, D. L. Untersuchungen über Röntgensensibilisierung. I. Über den Mechanismus der Sensibilisierung durch Iodsalze. (Studies of roentgen sensitization. I. The mechanism of sensitization by iodine salts.) *Strahlentherapie*, 1929, *34*, 414–420.

The technique of the author's experiments is described. Some authors think the biological effect of roentgen rays can be considerably increased by sensitizing substances. Substances are used as sensitizers that have a high atomic weight which on irradiation send out softer secondary rays and electrons. Iodine compounds are used particularly. The author has found however that it is not the iodine solution that increases the action of the roentgen rays, but the rays bring about a chemical decomposition of the solution, splitting off free iodine, which is extremely toxic, from its salts. This decomposition of the iodine salt is a roentgen chemical reaction brought about by the direct action of the rays. But under the ordinary conditions of biological experimentation a much more important part is played by the indirect action of the rays, that is, oxidation of the iodine salt by the ozone formed in the air. If this chemical change in the solution is excluded by adding sodium hyposulphite no further sensitization takes place. Evidently the secondary rays and electrons sent out by the iodine atoms are not of any special importance.

Some practical medical facts can be explained in the same way. Melchior reported that when potassium iodide and roentgen rays were used at the same time their combined action on actinomycosis was increased. This increased therapeutic action was evidently due to activation of the iodine salt by setting iodine free.—*Audrey G. Morgan.*

Schreus, H. Th. Die Zerstörung des Cholesterins durch die Röntgenstrahlen in vitro. (The destruction of cholesterin by means of roentgen rays in vitro.) *Fortschr. a. d. Geb. d. Rontgenstrahlen*, Nov., 1929, *40*, 842–844.

This article constitutes an answer to a recent publication of Roffo and Correa (see abstract, this Journal, September, 1929, p. 303) regarding the action of roentgen rays on cholesterin in 0.25 per cent solutions of chloroform. After repeating the experiments (according to the instructions of Roffo and Correa) the author found that the difference in his results and those of Roffo and Correa was due to the variation in the amount of radiation applied.

In reviewing the whole problem the author admits that the final results of investigations are identical in the two instances. An effect of the roentgen rays on the cholesterin is observed only in the presence of chlor-containing solutions. The action is primarily on the chloroform and only secondarily through the destruction products of the chloroform on the cholesterin itself. In 0.25 per cent chloroform solutions a larger amount of radiation is necessary to bring about the destruction of cholesterin than in the case of standard (0.02 per cent) solutions.—*T. Leucutia.*

Beckwith, T. D., Olson, A. R., and Rose, E. J. The effect of x-ray upon bacteriophage and upon the bacterial organism. *Proc. Soc. Exper. Biol. & Med.*, Jan., 1930, *27*, 285–286.

Seven strains of *B. coli* bacteriophage and

six strains of *B. coli* were used in the following experiment. The organisms were young cultures in the phase of positive logarithmic growth in beef infusion broth and the phages were recent filtrates in the same medium. These were contained in lead-free glass test tubes. Exposure to roentgen rays was carried out at a distance of about 14 inches from the target of a roentgen tube operated at 75 kv. The exposure was for 30 minutes. Following treatment each bacteriophage was placed in contact with untreated organisms of each culture and the exposed bacterial culture was set up with each of the unexposed bacteriophages. Suitable controls were run. By this treatment three of the phages developed reduced effectiveness when brought into contact with organisms shown previously to be susceptible to them in the control series. But this reduction in activity does not, of necessity, appear when this same portion of irradiated phage is brought into contact with other strains of the colon bacillus. The diminution of effect thus may be selective as the result of irradiation. Likewise in three instances treatment of the cultures reduced the activity of the bacteriophage upon them. Again the effect may be selective since this same treated suspension, when brought into contact with other strains of *B. coli* phage, may still show the usual lysis. The effect, therefore, cannot be ascribed to sterilization of the cultures in all instances for they were not killed by this treatment.—*B. Cohen.*

WYCKOFF, RALPH W. G., and RIVERS, THOMAS M. Effect of cathode rays upon certain bacteria. *Proc. Soc. Exper. Biol. & Med.*, Jan., 1930, *27*, 312–314.

The organisms studied were *B. coli*, *Staphylococcus aureus* and *B. aertryke*. The cathode rays were obtained from a Coolidge electron tube operated at about 200 kv. Small numbers of organisms were evenly spread upon the surfaces of agar plates and known areas were exposed for different lengths of time to the electron stream. After incubation, counts were made of the numbers of colonies growing out in these areas and in similar standard areas shielded from radiation. By estimating both the number of electrons which strike a bacterium in unit time and the absorption coefficient of these electrons in the bacterium, it is possible to analyze the observed survival ratios by the usual methods of probability theory. Such an analysis will show how many electrons may be stopped by a single bacterium before death results. It will also indicate whether absorption must take place in a particular portion of the organism in order to be lethal. When motile bacilli of mouse typhoid were spread on agar so that not more than about 200 cells were in the area of 1 square inch the results agreed with the conclusion that one electron-hit is sufficient to kill. This was only obtained when the effects of cell multiplication were eliminated by irradiating immediately after seeding the plates. The same results were obtained for the less motile colon bacillus. Even under the most favorable conditions *Staphylococcus aureus* required more than one hit. However, examination of the suspension showed that the cocci were still for the most part clustered. The data indicate that the only differences that exist in the resistance of these organisms to 200 kv. electrons are due to their relative sizes. To obtain valid results it is absolutely necessary to eliminate clumping of cells and to prevent multiplication before irradiation, requirements which have not been met by the experimental procedures hitherto followed.—*B. Cohen.*